



DEPARTMENT OF ENERGY

10 CFR Part 430

[EERE-2019-BT-TP-0003]

RIN 1904–AE30

Energy Conservation Program: Test Procedures for Direct Heating Equipment

AGENCY: Office of Energy Efficiency and Renewable Energy, Department of Energy.

ACTION: Final rule.

SUMMARY: The U.S. Department of Energy (“DOE”) is amending the test procedure for direct heating equipment to incorporate by reference the most recent versions of the industry consensus test standards previously referenced in the Federal test procedure, while maintaining the existing oil pressure measurement error value. DOE is also updating definitions regarding unvented heaters, accounting for multiple operational modes, specifying the input rate for conducting the cyclic condensate collection test, specifying the use of manufacturer values for gas supply pressure in certain circumstances, specifying the allowable range of regulator outlet pressure and specific gravity, providing an option to use fewer thermocouples in the thermocouple grid for models with small-diameter flues, clarifying instructions for calculations regarding condensate mass measurements, and specifying the methods to appropriately shield thermocouples from radiation.

DATES: The effective date of this rule is **[INSERT DATE 30 DAYS AFTER DATE OF PUBLICATION IN THE *FEDERAL REGISTER*]**. The final rule changes will be mandatory for product testing starting **[INSERT DATE 180 DAYS AFTER DATE OF PUBLICATION IN THE *FEDERAL REGISTER*]**. The incorporation by reference of certain publications listed in the rule is approved by the Director of the Federal Register on **[INSERT DATE 30 DAYS AFTER DATE OF PUBLICATION IN THE *FEDERAL***

REGISTER] The incorporation by reference of other publications listed in this rulemaking was approved by the Director of the Federal Register on January 16, 2013.

ADDRESSES: The docket, which includes *Federal Register* notices, public meeting attendee lists and transcripts, comments, and other supporting documents/materials, is available for review at www.regulations.gov. All documents in the docket are listed in the www.regulations.gov index. However, some documents listed in the index, such as those containing information that is exempt from public disclosure, may not be publicly available. A link to the docket web page can be found at www.regulations.gov/docket?D=EERE-2019-BT-TP-0003. The docket web page contains instructions on how to access all documents, including public comments, in the docket.

For further information on how to review the docket contact the Appliance and Equipment Standards Program staff at (202) 287-1445 or by e-mail:

ApplianceStandardsQuestions@ee.doe.gov.

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For further information on how to submit a comment, review other public comments and the docket, or participate in the webinar, contact the Appliance and Equipment Standards Program staff at (202) 287-1445 or by e-mail: ApplianceStandardsQuestions@ee.doe.gov.

SUPPLEMENTARY INFORMATION:

DOE maintains a previously approved incorporation by reference (IEC 62301 (Second Edition)) and incorporates by reference the following industry standards into the Code of Federal Regulations (“CFR”) at 10 CFR part 430:

American National Standards Institute (“ANSI”)/American Society of Heating, Refrigerating, and Air-Conditioning Engineers (“ASHRAE”) Standard 103-2017, (“ANSI/ASHRAE 103-2017”), “Method of Testing for Annual Fuel Utilization Efficiency of Residential Central Furnaces and Boilers,” approved July 3, 2017.

Copies of ANSI/ASHRAE 103-2017 can be obtained from the American Society of Heating, Refrigerating, and Air-Conditioning Engineers, Inc., 180 Technology Parkway NW, Peachtree Corners, GA 30092, (800) 527-4723 or (404) 636-8400, or online at:

www.ashrae.org.

ANSI Standard Z21.86-2016 · CSA 2.32-2016 (“ANSI Z21.86-2016”), “Vented Gas-Fired Space Heating Appliances,” Sixth Edition, approved December 21, 2016.

Copies of ANSI Z21.86-2016 can be obtained from the CSA Group, 178 Rexdale Blvd, Toronto, ON, Canada M9W 1R3 or the American National Standards Institute, 25 W. 43rd Street, 4th Floor, New York, NY 10036, (212) 642-4900, or online at:

www.csagroup.org/store/ or *www.ansi.org*.

ASTM International (“ASTM”) D2156-09 (Reapproved 2018) (“ASTM D2156-09 (R2018)”), “Standard Test Method for Smoke Density in Flue Gases from Burning Distillate Fuels,” reapproved October 1, 2018.

Copies of ASTM D2156-09 (R2018) can be obtained from ASTM International, 100 Barr Harbor Drive, P.O. Box C700, West Conshohocken, PA 19428-2959 or online at:

www.astm.org.

International Electrotechnical Commission (“IEC”) 62301 (“IEC 62301 (Second Edition)”), “Household electrical appliances—Measurement of standby power,” Edition 2.0 2011-01.

Copies of IEC 62301 (Second Edition) can be obtained from the American National Standards Institute, 25 W. 43rd Street, 4th Floor, New York, NY 10036, (212) 642-4900, or online at: www.webstore.ansi.org.

Underwriters Laboratories, Inc. (“UL”) 729 (“UL 729-2016”), “Standard for Safety for Oil-Fired Floor Furnaces,” approved November 22, 2016.

UL 730 (“UL 730-2016”), “Standard for Safety for Oil-Fired Wall Furnaces,” approved November 22, 2016.

UL 896 (“UL 896-2016”), “Standard for Safety for Oil-Burning Stoves,” approved November 22, 2016.

Copies of UL 729-2016, UL 730-2016, and UL 896-2016 can be obtained from Underwriters Laboratories, Inc., 2600 NW. Lake Rd., Camas, WA 98607-8542 or online at: www.ul.com.

See section IV.N of this document for a further discussion of these standards.

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I. Authority and Background

Direct heating equipment (“DHE”) is included in the list of “covered products” for which DOE is authorized to establish and amend energy conservation standards and test procedures. (42 U.S.C. 6292(a)(9)) DOE defines “direct heating equipment” as vented home heating equipment and unvented home heating equipment. 10 CFR 430.2. (Hereafter in this final rule, the terms “vented heater” and “unvented heater” are used to describe the two types of DHE). DOE’s energy conservation standards and test procedures for vented heaters are currently prescribed at 10 CFR 430.32(i) and 10 CFR part 430, subpart B, appendix O, “Uniform Test Method for Measuring the Energy Consumption of Vented Home Heating Equipment” (“appendix O”), respectively. DOE’s test procedures for unvented heaters are prescribed at 10 CFR part 430, subpart B, appendix G, “Uniform Test Method for Measuring the Energy Consumption of Unvented Home Heating Equipment” (“appendix G”). DOE currently does not prescribe energy conservation standards for unvented heaters because, as the Department explained in an April 2010 final rule for DHE, DOE has previously determined that a standard would produce little energy savings (largely due to the fact that any heat losses are dissipated directly into the conditioned space) and because of limitations in the applicable DOE test procedure. 75 FR 20112, 20130 (April 16, 2010). The appendix G test procedure includes neither a method for measuring energy efficiency nor a descriptor

for representing the efficiency of unvented heaters. Instead, appendix G provides a method to measure and calculate the rated output (for all unvented heaters) and annual energy consumption (for primary electric unvented heaters). The following sections discuss DOE’s authority to establish and amend test procedures for vented and unvented heaters, as well as relevant background information regarding DOE’s consideration of and amendments to test procedures for these products.

A. Authority

The Energy Policy and Conservation Act, as amended (“EPCA”),¹ authorizes DOE to regulate the energy efficiency of a number of consumer products and certain industrial equipment. (42 U.S.C. 6291–6317) Title III, Part B² of EPCA established the Energy Conservation Program for Consumer Products Other Than Automobiles, which sets forth a variety of provisions designed to improve energy efficiency. These products include DHE, the subject of this document. (42 U.S.C. 6292(a)(9))

The energy conservation program under EPCA consists essentially of four parts: (1) testing, (2) labeling, (3) Federal energy conservation standards, and (4) certification and enforcement procedures. Relevant provisions of EPCA specifically include definitions (42 U.S.C. 6291), test procedures (42 U.S.C. 6293), labeling provisions (42 U.S.C. 6294), energy conservation standards (42 U.S.C. 6295), and the authority to require information and reports from manufacturers (42 U.S.C. 6296).

The Federal testing requirements consist of test procedures that manufacturers of covered products must use as the basis for: (1) certifying to DOE that their products comply with the applicable energy conservation standards adopted under EPCA (42 U.S.C. 6295(s)), and (2) making representations about the efficiency of those products (42 U.S.C. 6293(c)).

¹All references to EPCA in this document refer to the statute as amended through the Energy Act of 2020, Pub. L. 116-260 (Dec. 27, 2020)), which reflect the last statutory amendments that impact Parts A and A-1 of EPCA.

² For editorial reasons, upon codification in the U.S. Code, Part B was redesignated Part A.

Similarly, DOE must use these test procedures to determine whether the products comply with any relevant standards promulgated under EPCA. (42 U.S.C. 6295(s)) EPCA defines the efficiency descriptor for DHE to be annual fuel utilization efficiency (“AFUE”). (42 U.S.C. 6291(22)(A))

Federal energy efficiency requirements for covered products established under EPCA generally supersede State laws and regulations concerning energy conservation testing, labeling, and standards. (42 U.S.C. 6297) DOE may, however, grant waivers of Federal preemption for particular State laws or regulations, in accordance with the procedures and other provisions of EPCA. (42 U.S.C. 6297(d))

Under 42 U.S.C. 6293, EPCA sets forth the criteria and procedures DOE must follow when prescribing or amending test procedures for covered products. EPCA requires that any test procedures prescribed or amended under this section shall be reasonably designed to produce test results which measure energy efficiency, energy use or estimated annual operating cost of a covered product during a representative average use cycle (as determined by the Secretary) or period of use and shall not be unduly burdensome to conduct. (42 U.S.C. 6293(b)(3))

In addition, EPCA requires that DOE amend its test procedures for all covered products to integrate measures of standby mode and off mode energy consumption into the overall energy efficiency, energy consumption, or other energy descriptor, taking into consideration the most current versions of Standards 62301³ and 62807⁴ of the International Electrotechnical Commission (IEC), unless the current test procedure already incorporates the standby mode and off mode energy consumption, or if such integration is technically infeasible. (42 U.S.C. 6295(gg)(2)(A)) If an integrated test procedure is technically

³ IEC 62301, *Household electrical appliances—Measurement of standby power* (Edition 2.0, 2011-01).

⁴ IEC 62087, *Audio, video and related equipment—Methods of measurement for power consumption* (Edition 1.0, Parts 1-6: 2015, Part 7:2018).

infeasible, DOE must prescribe separate standby mode and off mode energy use test procedures for the covered product, if a separate test is technically feasible. *Id.*

EPCA also requires that, at least once every 7 years, DOE evaluate test procedures for each type of covered product, including DHE, to determine whether amended test procedures would more accurately or fully comply with the requirements for the test procedures to not be unduly burdensome to conduct and be reasonably designed to produce test results that reflect energy efficiency, energy use, and estimated operating costs during a representative average use cycle or period of use. (42 U.S.C. 6293(b)(1)(A))

If the Secretary determines, on her own behalf or in response to a petition by any interested person, that a test procedure should be prescribed or amended, the Secretary shall promptly publish in the *Federal Register* proposed test procedures and afford interested persons an opportunity to present oral and written data, views, and arguments with respect to such procedures. The comment period on a proposed rule to amend a test procedure shall be at least 60 days and may not exceed 270 days. In prescribing or amending a test procedure, the Secretary shall take into account such information as the Secretary determines relevant to such procedure, including technological developments relating to energy use or energy efficiency of the type (or class) of covered products involved. (42 U.S.C. 6293(b)(2)) If DOE determines that test procedure revisions are not appropriate, DOE must publish in the *Federal Register* its determination not to amend the test procedures. DOE is publishing this final rule in satisfaction of the 7-year review requirement specified in EPCA. (42 U.S.C. 6293(b)(1)(A))

B. Background

As mentioned previously, DOE's existing test procedures for unvented heaters and vented heaters appear at appendix G and appendix O, respectively. DOE published a notice of proposed rulemaking ("NOPR") on April 16, 2021 ("April 2021 NOPR") that provides the

full history of test procedure rulemakings for unvented heaters and vented heaters. 86 FR 20053, 20055-20056.

For unvented electric heaters that are the primary heating source for the home, appendix G includes provisions for measuring electric power and calculating annual energy consumption in sections 2.1 and 3.1, respectively. For all unvented heaters, appendix G includes provisions for determining the rated output, in section 3.3 for electric heaters and section 3.4 for natural gas, propane, or oil heaters. Appendix G does not contain provisions for determining energy efficiency, as unvented heaters are considered to be 100-percent efficient during the heating season because any heat losses are lost to the conditioned living space in which the unit is installed. Accordingly, DOE has not established energy conservation standards for unvented heaters.

For vented heaters, appendix O includes provisions for determining AFUE, which is the efficiency metric used for determining compliance with the energy conservation standards for vented home heating equipment found in 10 CFR 430.32(i)(2). Section 4.6 of appendix O also specifies provisions for calculating the annual energy consumption of vented heaters. Manufacturers must use the test procedure at appendix O to demonstrate compliance with the current energy conservation standards for vented heaters. Further, there are currently no industry consensus test methods to measure DHE energy efficiency under the AFUE metric for vented home heating equipment.

To better understand potential issues with the current test procedures since the last amendments, DOE published a request for information (“RFI”) on February 26, 2019 (“February 2019 RFI”). 84 FR 6088. Following the February 2019 RFI, DOE published the April 2021 NOPR. 86 FR 20053.

DOE received comments in response to the April 2021 NOPR from the interested parties listed in Table I.1.

Table I.1 Comments Received in Response to the April 2021 NOPR

Commenter(s)	Reference in this Final Rule	Commenter Type
Association of Home Appliance Manufacturers	AHAM	Trade Association
Air-conditioning, Heating, and Refrigeration Institute	AHRI	Trade Association
Pacific Gas and Electric Company, Southern California Edison, and San Diego Gas & Electric Company; collectively, the California Investor-Owned Utilities	CA IOUs	Utility
Ethel Kecaph	Ethel Kecaph	Individual
Flux Tailor	Flux Tailor	Consultant
Appliance Standards Awareness Project, Natural Resources Defense Council	Joint Advocates	Efficiency Organizations
Northwest Energy Efficiency Alliance	NEEA	Efficiency Organization

A parenthetical reference at the end of a quoted or paraphrased comment provides the location of the item in the public record.⁵

II. Synopsis of the Final Rule

In this final rule, DOE amends the test procedures for unvented and vented heaters (Appendices G and O, respectively) and several associated definitions in 10 CFR 430.2, as follows:

- Update the definitions of “floor electric heater,” “primary heater,” “unvented gas heater,” “unvented home heating equipment,” “unvented oil heater,” “vented home heating equipment,” and “vented room heater;” and update the terms “primary heater” and “supplementary heater” to “primary electric heater” and “supplementary electric heater,” respectively;
- Update references to several industry consensus standards to the most recent versions, except that the test procedure maintains the existing oil pressure measurement error value (which was omitted in the most recent update to ANSI/ASHRAE 103-2017);

⁵ The parenthetical reference provides a reference for information located in the docket of DOE’s rulemaking to develop test procedures for DHE. (Docket No. EERE-2019-BT-TP-0003, which is maintained at www.regulations.gov). The references are arranged as follows: (commenter name, comment docket ID number, page of that document).

- Provide explicit direction on the operational mode for testing vented heaters with multiple automatic operation modes;
- Clarify the required input rate for the cyclic condensate collection tests;
- Allow for the use of the manufacturer-specified gas inlet pressure range when the required input rating cannot be achieved;
- Explicitly state the regulator outlet pressure and specific gravity tolerances for the gas supply;
- Provide the option to use five, rather than nine, thermocouples for the thermocouple grid in models with small (2-inch diameter or less) flues;
- Clarify the wording of the cyclic condensate collection test in the calculation of the allowable variance in condensate mass measurements; and
- Provide explicit direction on the methods to appropriately shield thermocouples from radiation.

The adopted amendments are summarized in Table II.1 compared to the test procedure provision prior to the amendment, as well as the reason for the adopted change.

Table II.1 Summary of Changes in Amended Test Procedures Relative to Previous Test Procedures

Previous DOE Test Procedure	Amended Test Procedure	Attribution
Definitions for electric heater, primary heater, supplementary heater, floor electric heater, unvented gas heater, unvented home heating equipment, unvented oil heater, vented home heating equipment, and vented room heater had various inconsistencies in terminology.	Updates the definitions to use consistent terminology.	Ensure consistent use and application. Response to comments.
Referenced ANSI/ASHRAE 103-2007, ANSI Z21.86-2008, ASTM D-2156-09, UL 729-2003, UL 730-2003, and UL 896-1993.	References ANSI/ASHRAE 103-2017 (but maintains existing oil pressure measurement error value), ANSI Z21.86-2016, ASTM D2156-09 (R2018), UL 729-2016, UL 730-2016, and UL 896-2016.	Update to most recent versions of industry standards. Response to comments.
Did not provide specific direction for units with multiple automatic operational modes.	Explicitly provides that for units with multiple automatic operational modes, the default or other similarly named mode is used for testing.	Ensure representativeness, repeatability, and reproducibility. Response to comments.
Did not provide specific direction regarding the input rate at which the	Explicitly states at which input rate to conduct the cyclic condensate collection test.	Ensure repeatable and reproducible results.

Previous DOE Test Procedure	Amended Test Procedure	Attribution
cyclic condensate collection test is to be conducted.		
Specified an inlet gas pressure level is to be between 7–10 inches water column.	Permits use of manufacturer’s specified gas inlet pressure range, if the nameplate input rating ± 2 percent cannot be achieved at 7–10 inches water column.	Ensure representativeness repeatability, and reproducibility.
Did not provide specific values that the regulator outlet pressure and specific gravity of the test gas must meet.	Explicitly state that the regulator outlet pressure be within the greater of ± 10 percent of the manufacturer-specified manifold pressure or ± 0.2 inches water column, and that the specific gravity for natural gas and propane gas be 0.57–0.70 and 1.522–1.574, respectively.	Ensure consistent use and application. Ensure representativeness repeatability, and reproducibility.
Required use of a nine-thermocouple grid for measuring flue gas temperature, regardless of flue size.	For smaller size flues (2-inch diameter or less), require a five-thermocouple grid.	Reduce test burden, ensure representativeness.
For the variance of the condensate mass measurements, required that “the sample standard deviation is within 20 percent of the mean value for three cycles” in order to stop at three cycles. Otherwise, six cycles are required.	Clarifies that the standard deviation must be less than or equal to 20 percent of the mean value.	Clarification. Ensure representativeness repeatability, and reproducibility.
Did not provide specific direction for determining when a radiation shield is needed or what an appropriate radiation shield would be.	Explicitly states that any thermocouple with a direct line of sight to the burner must be shielded from radiation and that a radiation shield with an explicitly stated material and minimum thickness must be used.	Clarification. Ensure representativeness repeatability, and reproducibility.

DOE has determined that the amendments described in section III of this final rule will not alter the measured efficiency of DHE or require retesting or recertification solely as a result of DOE's adoption of the amendments to the test procedures. Additionally, DOE has determined that the amendments will not increase the cost of testing. Discussion of DOE’s actions are addressed in detail in section III of this final rule.

The effective date for the amended test procedures adopted in this final rule is 30 days after publication of this document in the *Federal Register*. Representations of energy use or energy efficiency must be based on testing in accordance with the amended test procedures beginning 180 days after the publication of this final rule.

III. Discussion

A. Definitions

1. Unvented Heaters

In the April 2021 NOPR, DOE proposed several changes to the definitions pertaining to unvented heaters, including: (1) changing the phrasing from “heat” or “warm air” to

“heated air,” as the term “warm” is subjective and does not indicate that any process was used to add heat to the air being furnished by the heater, whereas “heated” indicates that thermal energy was added to the air; (2) explicitly including floor electric heaters as one of the examples provided in the definition of a “primary electric heater,” given that, to the extent that a floor electric heater is the principal source of heat for a structure, it is a primary heater; (3) adding the phrase “a class of unvented home heating equipment” to the definitions of “electric heater,” “unvented gas heater,” and “unvented oil heater,” to more clearly associate these definitions as being unvented home heating equipment; and (4) specifying that “unvented home heating equipment or unvented heater” furnishes heated air “without exhaust venting,” as the prior definition did not state this explicitly. 86 FR 20053, 20057–20058 (April 16, 2021).

AHAM, the CA IOUs, and NEEA generally stated their support of DOE’s proposed updates to the DHE definitions. (AHAM, No. 15 at p. 1; CA IOUs, No. 14 at p. 1; NEEA, No. 16 at p. 1)

For the reasons identified in the preceding discussion and discussed in the April 2021 NOPR, this final rule amends the definitions pertaining to unvented heaters as proposed in the April 2021 NOPR.

2. Vented Heaters

In the April 2021 NOPR, DOE proposed updates to the definitions pertaining to vented heaters in 10 CFR 430.2, including: (1) changing the phrasing of “warm” or “warmed” air to “heated” air in the definitions of “vented home heating equipment or vented heater” and “vented room heater,” for the reasons stated prior; (2) replacing the phrase “to the living space of a residence, directly from the device” in the “vented home heating equipment or vented heater” definition with “to a space proximate to such heater, directly from the heater” to align with the definition of “unvented home heating equipment or unvented heater,” and (3) specifying that “vented home heating equipment or vented heater”

furnishes heated air “with exhaust venting,” as the prior definition did not state this explicitly. 86 FR 20053, 20058–20059 (April 16, 2021).

AHAM, the CA IOUs, and NEEA generally stated their support of DOE’s proposed updates to the DHE definitions. (AHAM, No. 15 at p. 1; CA IOUs, No. 14 at p. 1; NEEA, No. 16 at p. 1)

For the reasons identified in the preceding discussion and discussed in the April 2021 NOPR, this final rule amends the definitions pertaining to vented heaters as proposed in the April 2021 NOPR.

B. Updates to Industry Consensus Test Methods

The unvented home heating equipment test procedure in appendix G referenced the International Electrotechnical Commission (“IEC”) 62301, “Household electrical appliances – Measurement of standby power,” (Second Edition). The vented home heating equipment test procedure in appendix O referenced the following industry standards:

- ANSI/ASHRAE Standard 103-2007, “Method of Testing for Annual Fuel Utilization Efficiency of Residential Central Furnaces and Boilers” (“ANSI/ASHRAE 103-2007”);
- ANSI Z21.86-2008, “Vented Gas-Fired Space Heating Appliances” (“ANSI Z21.86-2008”);
- ASTM D2156-09, “Standard Test Method for Smoke Density in Flue Gases from Burning Distillate Fuels” (“ASTM D2156-09”);
- IEC 62301 (Second Edition), “Household electrical appliances—Measurement of standby power” (“IEC 62301 (Second Edition)”);
- UL 729-2003, “Standard for Safety for Oil-Fired Floor Furnaces” (“UL 729-2003”);
- UL 730-2003, “Standard for Safety for Oil-Fired Wall Furnaces” (“UL 730-2003”);
- and
- UL 896-1993, “Standard for Safety for Oil-Burning Stoves” (“UL 896-1993”).

As described in the April 2021 NOPR, each of the referenced industry standards, except for ASTM D2156-09⁶ and IEC 62301 (Second Edition), have been superseded with a more recent version. 86 FR 20053, 20059. The changes in the most recent version of UL 729, UL 730, and UL 896 were made to sections not referenced by the DOE test procedure; and the changes in the most recent version of ANSI Z21.86, while affecting sections referenced by the DOE test procedure, were non-substantive and unlikely to have any impact on the test burden or measured energy consumption under the DOE test procedure. *Id.* DOE proposed to update the references to these industry standards to their most recent versions: ASTM D2156-09 (R2018), UL 729-2016, UL 730-2016, UL 896-2016, and ANSI Z21.86-2016.

DOE received no comments regarding its proposal to update these industry standards to their most recent versions.

In this final rule, DOE updates the references to the industry standards to the most recent versions for ASTM D2156-09, UL 729, UL 730, UL 896, and ANSI Z21.86, consistent with the proposal in the April 2021 NOPR.

ANSI/ASHRAE 103-2007, referenced in appendix O, has been superseded by ANSI/ASHRAE 103-2017. In the April 2021 NOPR, DOE discussed the various substantive changes between ANSI/ASHRAE 103-2007 and ANSI/ASHRAE 103-2017 and the proposed changes to appendix O to address the changes, including: (1) adding the oil pressure measurement error values from ANSI/ASHRAE 103-2007 to appendix O (as these were not retained in ANSI/ASHRAE 103-2017); (2) incorporating by reference the equations to determine jacket loss provided in Section 8.6 of ANSI/ASHRAE 103-2017 (as the equations in ANSI/ASHRAE 103-2017 provide more accurate values as compared to the figures provided in the 2007 version and mitigate the possibility of human error in interpreting the figures); and (3) removing the mention of Sections 8.8.3 and 9.10 of ANSI/ASHRAE 103-

⁶ASTM D2156-09 was reapproved in 2018 (ASTM D2156-09 (R2018)) without modification.

2007 within section 3.6.2.4.2 of appendix O (as all the information stated in Section 8.8.3 of ANSI/ASHRAE 103-2007 is already stated in sections 3.6.1 and 3.6.2 of appendix O; and the inclusion of a reference to Section 9.10 of ANSI/ASHRAE 103-2007 could cause confusion due to the maximum post-purge requirement, which is not discussed within appendix O). 86 FR 20053, 20059–20060

The CA IOUs stated their support of DOE's decision to update the reference to the most recent version of ANSI/ASHRAE 103, stating that it will allow for more consistent test results. (CA IOUs, No. 14 at p. 1) The CA IOUs also stated their support of DOE's proposed decision to add the allowable error in the oil pressure measurement value as defined in ANSI/ASHRAE 103-2007 back into the test procedure to maintain consistency for manufacturers and contractors. (CA IOUs, No. 14 at p. 1) No additional comment was received on the proposal regarding the amendments related to the ANSI/ASHRAE 103 update.

For the reasons discussed in the April 2021 NOPR, in this final rule, DOE adopts ANSI/ASHRAE 103-2017 with the modifications as proposed in the April 2021 NOPR. 86 FR 20053, 20072–20073.

C. Unvented Heaters

1. Calculation of Annual Energy Consumption

For electric heaters, section 2.1 of appendix G specifies a requirement for measuring and recording the maximum electrical power consumed when heating, in terms of kilowatts, and section 3.3 specifies a requirement for calculating a rated output. For primary electric heaters only, section 3.1 of appendix G specifies a calculation for the national average annual energy consumption based on the maximum electrical power, and section 3.2 specifies a calculation for the annual energy consumption by geographic region. The calculation of national average annual energy consumption in section 3.1 of appendix G is based on several assumptions, including the national average annual heating load hours of 2080, an adjustment

factor of 0.77,⁷ and a typical oversizing factor for primary electric heaters of 1.2.⁸ The calculation of regional annual energy consumption in section 3.2 of appendix G is based on the same assumptions as the national value, except that regional heating load hours are provided by a Figure 1, depicting geographic regions the United States and the associated heating load hours for each region. Appendix G does not specify a method for calculating annual fuel energy consumption for unvented gas and oil heaters.

In the April 2021 NOPR, DOE did not propose changes to the national and regional values used in the calculations of annual energy consumption based on the tentative determination that the existing calculations and assumptions are still appropriate. 86 FR 20053, 20061. DOE also did not propose to add calculations for annual fuel energy consumption of gas and oil unvented heaters because DOE tentatively concluded that such calculations would be unlikely to provide consumers with valuable information and could potentially confuse consumers if comparisons are made between vented and unvented heaters without the full understanding of the different applications and utilities of each product. *Id.*

DOE did not receive any comments on its proposals to maintain the existing national and regional values used for calculating annual energy consumption and to not add calculations for annual fuel energy consumption of gas and oil unvented heaters. Therefore, DOE maintains its conclusions from the April 2021 NOPR and is not adopting changes related to these issues.

⁷ The adjustment factor is a multiplier to adjust the heating load hours to the approximate burner operating hours experienced by the system.

⁸ The oversizing factor accounts for space heating products generally being oversized when compared to the actual required heating load.

2. Standby Mode and Off Mode Energy Consumption

Section 2.3 of appendix G requires measuring the pilot light input rate except for those products specified in section 2.3.1 of appendix G;⁹ however, the pilot light measurement is not used in the calculation of rated output in section 3.4 of appendix G.

In the April 2021 NOPR, DOE did not propose to include standby mode and off mode energy consumption into the annual energy consumption for unvented heaters, having tentatively determined that the standby mode energy consumption of unvented heaters is as effective at heating the space as active mode energy, and, therefore, it is unnecessary to integrate. 86 FR 20053, 20061–20062. Regarding off mode energy consumption, DOE tentatively concluded in the April 2021 NOPR that some consumers could potentially leave the pilot light on during the non-heating season, thereby resulting in consumption of additional energy. However, in its review of the market, DOE found that all identified models with a pilot light included instructions from the manufacturer for turning the pilot light off during the non-heating seasons. *Id.* DOE stated that it lacks data for the operational hours in off mode and the percentage of consumers that do not turn their pilot lights off during the non-heating seasons, thereby making it impossible to determine whether a problem exists or its magnitude. *Id.* Based on the presence of manufacturer instructions and lack of data on representative use, DOE did not propose to incorporate off mode energy use in the test procedure. *Id.*

The Joint Advocates encouraged DOE to continue investigating off mode energy use for unvented heaters, asserting that DHE models with standing pilot lights waste a significant amount of energy in off mode and that the instructions provided to turn the pilot light off may do little to reduce the operating hours of standing pilot lights. (Joint Advocates, No. 13

⁹ Section 2.3.1 of appendix G specifies that that measurement of the pilot light input rate is not required for unvented heaters where the pilot light is designed to be turned off by the user when the heater is not in use (*i.e.*, for units where turning the control to the OFF position will shut off the gas supply to the burner(s) and the pilot light) and instruction to turn off the unit is provided on the heater near the gas control valve (*e.g.*, by label).

at p. 1) The CA IOUs requested that DOE further investigate the opportunity for regulation of standing pilot lights. (CA IOUs, No. 14 at pp. 2–3) The CA IOUs cited a NOPR that DOE published on February 9, 2015, for hearth products and a Statistics Canada study¹⁰ that both showed that 44 percent of consumers do not turn off their fireplace standing pilot light during the non-heating season. The CA IOUs asserted that these results should provide an indication of the percentage of households that leave the standing pilot light on all year for DHE. *Id.* The CA IOUs stated that its research has uncovered products that do not appear to have directions in the manual for turning the pilot light off during the non-heating seasons. *Id.* The CA IOUs further requested that DOE demonstrate why consumer behavior regarding standing pilot lights would be different for DHE products and hearth products and provide more information regarding the market research conducted to make this determination. *Id.*

In response, DOE notes that, in addition to providing heat, consumers also purchase hearth products for aesthetic purposes. The sole purpose of unvented heaters, however, is to provide heat. As a result, the product designs, installation locations, and usage patterns may be significantly different for hearth products as compared to unvented heaters. These differences, especially differences in the way the consumer uses the appliance, could lead users to behave differently with respect to turning off the pilot light. In a final determination regarding energy conservations standards for DHE published on November 23, 2021, DOE considered this issue and agreed that amendments to appendix G to limit the exclusion to unvented heaters that are controlled with a thermostat or manually-controlled unvented heaters with both a fully off mode and a pilot on mode may be appropriate. 86 FR 66403, 66411. However, DOE stated that the information regarding hearth products cannot be used directly for unvented heaters because hearth products may be used differently than unvented heaters, and, at the time of the determination, DOE had not received information regarding consumer behavior for unvented heaters. *Id.* Regarding the comments on this rulemaking,

¹⁰ Statistics Canada study: www150.statcan.gc.ca/n1/pub/11-526-s/2013002/t013-eng.htm.

the commenters did not present new information on the usage of pilot lights in unvented heaters during the non-heating season that would allow DOE to determine whether a significant number of unvented heater consumers leave the standing pilot light on during the non-heating season, or to draw comparisons between usage of pilot lights in hearth products as compared to unvented heaters. As a result, DOE maintains its position from the April 2021 NOPR that it lacks data at this time regarding the operational hours of the pilot in off mode and the percentage of consumers that do not turn their pilot lights off during the non-heating seasons, which would be needed for DOE to incorporate a representative measure of off mode energy use in the test procedure. DOE will continue to investigate this issue and, if appropriate, will address the pilot light energy consumption in a future rulemaking proceeding.

3. Efficiency Assumption

As stated in section I.B of this document, appendix G does not contain provisions for determining the energy efficiency of unvented heaters, as they are considered to be 100-percent efficient due to the fact that any heat loss from the heater is transferred to the conditioned space in which the unit is installed. Thus, DOE has not established energy conservation standards for unvented heaters.

In the February 2019 RFI, DOE noted the absence of provisions for calculating the energy efficiency of unvented heaters in appendix G and sought comment on whether calculations for the annual fuel energy consumption of unvented gas, propane, and oil heaters should be added to the test procedure. 84 FR 6088, 6092 (Feb. 26, 2019). In response, AHRI recommended against calculating annual fuel energy consumption for unvented gas and oil heaters, stating that all heat is contained within the conditioned space, so that such products should be considered 100-percent efficient. (AHRI, No. 5 at p. 2). NEEA commented that unvented heaters have higher efficiencies than vented heaters because all the heated air and combustion gases are delivered to the consumer's heated space. (NEEA, No.

7 at pp. 1–2) The Joint Advocates recommended that DOE require the annual fuel energy consumption calculations for gas and oil unvented heaters to ensure that any representations of annual energy use for these products would be based on a consistent calculation methodology. (Joint Advocates, No. 6 at p. 1)

In the April 2021 NOPR, DOE did not propose to add calculations for annual fuel energy consumption of gas and oil unvented heaters to appendix G, having tentatively determined that such calculations would be unlikely to provide consumers with valuable information, and that an annual fuel energy consumption value for unvented gas and oil heaters could potentially confuse consumers if comparisons are made to the values for vented heaters without full understanding of the different applications and utilities of each product. 86 FR 20053, 20062.

In response to the April 2021 NOPR, the CA IOUs asserted that some unvented heaters, depending on installed conditions, may lose heat to an unconditioned space such as a wall or ceiling, which could result in the consumer setting the unit’s thermostat higher, ultimately leading to more energy consumption relative to a unit with less peripheral heat loss. The CA IOUs urged DOE to perform further analysis that includes the installation and use of unvented heaters to verify its assumption of 100 percent efficiency. (CA IOUs, No. 14 at p. 2)

AHAM stated its support of DOE’s assumption that unvented heaters are 100 percent efficient and commented that it would object to amendments that would add efficiency or energy calculations for unvented heaters that are not used as the primary heating source for the home. (AHAM, No. 15 at pp. 1–2)

Flux Tailor stated that the rate at which the unvented heater heats the conditioned space affects the energy use of the product, as the unvented heater will operate less if the conditioned space is heated more quickly. (Flux Tailor, Public Meeting Transcript, No. 12 at pp. 20–22)

In response to the CA IOUs comment, DOE notes that unvented heaters can typically be installed either on the wall or ceiling, or free-standing within the room (mounted on supports that are provided with the unit or can be purchased separately). For an unvented heater installed on a wall or ceiling, a portion of the heat losses through the jacket may heat the wall or ceiling; however, the wall and ceiling are part of the overall envelope of the heated space. Therefore, DOE does not find such an installation would result in losses that do not provide heat to the conditioned space. Further, DOE notes that its assumption that unvented heaters are 100 percent efficient is consistent with the treatment of vented heaters in appendix O. The test procedure for vented heaters requires a jacket loss test for vented floor furnaces (section 3.2), but does not require this test for any other type of vented heater, because a floor furnace is the only type of vented heater that is considered to have some portion of the jacket outside the heated space.¹¹

In response to Flux Tailor’s comment, DOE notes that the total amount of heat supplied to a space to satisfy a given heat load would be the same regardless of the rate at which the heat is supplied. Supplying heat at a higher rate of energy consumption will satisfy a particular heating load more quickly (*i.e.*, the heater will be on for a shorter duration); whereas, supplying heat at a lower rate of energy consumption will satisfy the same heating load more slowly (*i.e.*, the heater will be on for a longer duration). In both cases, however, the total amount of energy consumption (*i.e.*, heat supplied to the room) would be the same. Therefore, DOE has determined not to amend appendix G to account for the rate at which an unvented heater can heat a conditioned space.

¹¹ A vented floor furnace is defined in part as being “suspended from the floor of the space being heated.” A vented room heater is defined in part as being “free-standing, nonrecessed.” A vented wall furnace is defined in part as “designed for incorporation in, or permanent attachment to, a wall of a residence.”

D. Vented Heaters

For vented heaters, appendix O specifies provisions for determining the product's AFUE, which is the efficiency descriptor established by EPCA for these products. (42 U.S.C. 6291(22)(A))

1. Models with Multiple Automatic Operation Modes

Section 2.11 of appendix O specifies that for equipment that has both manual and automatic thermostat control modes, the unit must be tested according to the procedure for its automatic control mode (*i.e.*, single-stage, two-stage, or step-modulating). However, when a unit has multiple automatic operational modes, the test procedure did not explicitly specify what automatic operating mode must be used for testing.

In the April 2021 NOPR DOE proposed to amend section 2.11 of appendix O to explicitly specify that models with multiple automatic operation modes be tested in the mode suggested by the manufacturer for normal operation or the default mode as defined in the manufacturer's installation and operations manual. If a default mode is not defined in the product literature, DOE proposed that tests be conducted in the mode in which the product operates as shipped from the manufacturer. 86 FR 20053, 20062.

DOE received no comments on its proposal. In this final rule, DOE amends section 2.11 of appendix O, consistent with the proposal in the April 2021 NOPR, to require equipment that has multiple automatic thermostat control modes to be tested in the default mode (or similarly named mode identified for normal operation) as defined by the manufacturer in its installation and operation ("I&O") manual. If a default mode is not defined in the I&O manual, such equipment must be tested in the mode in which the equipment operates as shipped from the manufacturer.

2. Fuel Supply and Burner Adjustments

Sections 2.3.1 and 2.3.2 of appendix O required that for natural gas-fueled and propane gas-fueled vented heaters, the gas supply be maintained at a normal inlet test

pressure immediately ahead of all controls at 7 to 10 inches water column and 11 to 13 inches water column, respectively. In addition, section 2.4.1 of appendix O requires that the fuel flow rate be set to obtain a heat rate of within ± 2 percent of the hourly Btu rating specified by the manufacturer, as measured after 15 minutes of operation. Section 2.4.2 of appendix O requires that the burners of oil fueled vented heaters be adjusted to give the CO₂ reading recommended by the manufacturer and an hourly Btu input during steady-state operation within ± 2 percent of the heater manufacturer's specified normal hourly Btu input rating. In addition, on units employing a power burner, section 2.4.2 requires that smoke in the flue not exceed a No. 1 smoke during the steady-state performance test as measured by the procedure in ASTM D2156. During exploratory testing performed for the development of the April 2021 NOPR, only one tested gas-fired unit was unable to achieve the nameplate input rate within ± 2 percent while maintaining a natural gas supply pressure of 7 to 10 inches water column. The manufacturer's recommended gas inlet pressure for this model was 5 to 10.5 inches water column, and the nameplate input rating was achieved at a natural gas supply pressure of 5 inches water column.

In the April 2021 NOPR, DOE proposed several changes to appendix O, as follows. First, DOE proposed to specify that if the heater is equipped with a gas pressure regulator, that the regulator outlet pressure be maintained within the greater of ± 0.2 inches water column and ± 10 percent of the manufacturer-specified manifold pressure on the nameplate of the unit or in the installation and operation (“I&O”) manual. DOE reasoned that this would ensure consistency in setting the regulator outlet pressure and align with DOE test procedures for other gas-fired heating products such as consumer water heaters and commercial water heaters. 86 FR 20053, 20062. Second, DOE proposed to require that the specific gravity be between 0.57 and 0.70 for natural gas and 1.522 and 1.574 for propane gas, instead of “approximately” 0.65 and 1.53 for natural gas and propane gas, respectively, in order to better align the test procedure in appendix O with Annex G of ANSI Z21.86-2016.

Id. Third, DOE proposed to specify that if the burner cannot be adjusted to obtain a heat input rate of within ± 2 percent of the hourly Btu rating specified by the manufacturer on the nameplate of the unit or in the I&O manual, as required by section 2.4.1 of appendix O, the gas supply to the unit under test at an inlet test pressure immediately ahead of all controls may be set to any value within the range specified by the manufacturer on the nameplate of the unit or in the I&O manual. DOE reasoned that this change, if adopted, would ensure models are tested at conditions representative of field conditions while still maintaining consistency and repeatability. *Id.* Finally, DOE proposed to remove the word “normal” from sections 2.3.1 and 2.3.2 of appendix O (in reference to “normal inlet test pressure”), and replace the phrase “normal hourly Btu input rating” with “maximum hourly Btu input rating” within section 2.4.2 of appendix O. In doing so, DOE explained that because the test pressures within section 2.3 of appendix O were proposed to be explicitly stated, the use of the phrase “normal” would no longer be necessary, and the proposed change to replace “normal hourly Btu input rating” with “maximum hourly Btu input rating” would better align the input rate language throughout section 2.4 of appendix O. *Id.* at 20063.

DOE received no comments on its proposals. For the reasons discussed in the preceding paragraphs and in the April 2021 NOPR, in this final rule, DOE amends sections 2.3.1, 2.3.2, 2.4.1, and 2.4.2 of appendix O consistent with the proposals in the April 2021 NOPR.

3. Flue Thermocouples

Section 2.6 of appendix O required installation of nine thermocouples in the vent for measuring flue gas temperature for both gas-fueled and oil-fueled vented heaters. As discussed in the April 2021 NOPR, DOE has conducted testing on one unit for which the exhaust piping was 2 inches in diameter, and the nine thermocouples significantly restricted airflow in the vent, resulting in flue gas temperature readings and carbon monoxide levels above normal operating conditions. 86 FR 20053, 20063.

To ensure that measurements taken during testing of models with smaller flues (*i.e.*, 2 inches diameter or less) are representative of typical use, DOE proposed in the April 2021 NOPR an amendment to section 2.6 of appendix O to allow the test lab to use five thermocouples (consistent with the direction in ASHRAE 103-2017, section 7.6 and figure 10) when the flue size is less than or equal to 2 inches diameter. As explained in the April 2021 NOPR, given that the cross-sectional flue area is smaller for models with small vent diameter, fewer thermocouples may be needed to obtain accurate flue gas temperature measurements. Further, using fewer thermocouples would result in less flue restriction, and could more closely resemble operation in the field, thereby providing more representative flue gas readings. 86 FR 20053, 20063.

DOE received no comments on its proposal. In this final rule, DOE amends section 2.6 of appendix O to allow the test lab to use five thermocouples when the flue diameter is less than or equal to 2 inches.

4. Cyclic Condensate Collection Test

Section 3.8.2 of appendix O specifies the test procedure for collecting condensate under cyclic conditions for condensing vented heaters. During this test, three to six cycles of a 4-minute on-cycle followed by a 13-minute off-cycle are completed. The total mass of condensate and fuel energy input are then used in section 4.0 of appendix O, “Calculations.” The cyclic condensate collection test did not specify the input rate at which the burner should fire during the on-cycle times for units with modulating controls.

a. Input Rate

The cyclic condensate collection test was based on Section 9.8 of ANSI/ASHRAE 103-2007, which specifies that regarding the input rate for units with modulating controls, the following applies: (a) for step-modulating units, the test is conducted at the reduced¹²

¹² “Reduced heat input rate” is defined in section 1 of appendix O as the factory-adjusted lowest reduced heat input rate for vented home heating equipment equipped with either two-stage thermostats or step-modulating thermostats.

input rate only, which is defined in Section 3 of ANSI/ASHRAE 103-2007; or (b) for two-stage units, the test is conducted at both the maximum and reduced input rates unless the balance-point temperature (T_C) determined is equal to or less than the typical outdoor design temperature of 5 °F (−5°C), in which case the test is conducted at the reduced input rate only. The required input rate is specified in all other tests within the vented heater test procedure.

In the April 2021 NOPR, DOE proposed to explicitly provide input rate instructions similar to those in ANSI/ASHRAE 103-2007 to section 3.8.2 of appendix O to further align the vented heater test procedure with ANSI/ASHRAE 103. 86 FR 20053, 20063. DOE notes that the input rate instructions for units with modulating controls in Section 9.8 of ASHRAE 103-2007 and ASHRAE 103-2017 are essentially identical.

DOE received no comments on its proposal. In this final rule, DOE amends section 3.8.2 of appendix O to add input rate instructions for the cyclic condensate collection test equivalent to those in ANSI/ASHRAE 103-2017, consistent with the proposal in the April 2021 NOPR.

b. Condensate Mass Measurement Requirements

Section 3.8.2 of appendix O stated that if after three cycles “the sample standard deviation [of the mass of collected condensate] is within 20 percent of the mean value for three cycles,” the test can be ended, and the total mass collected in the three cycles can be used. Otherwise, three additional cycles of condensate collection are required, for a total of six cycles. DOE notes that the language for checking whether the variance of the condensate collected during the first three cycles is sufficiently small could be read to require that the standard deviation be “within 20 percent” of the mean value of the mass of condensate collected. Such a reading would not be logical because a small standard deviation is desirable for consistent results, and, therefore, the standard deviation value should not be compared directly to the mean and be required to be within 20 percent of the mean value. Rather, the phrase required that the standard deviation be at or below “20 percent of the mean

value” (*i.e.*, the sample standard deviation should be less than or equal to 20 percent of the mean).

To clarify the wording to avoid confusion that could result from the text, DOE proposed in the April 2021 NOPR to revise section 3.8.2 of appendix O to state that the standard deviation must be less than or equal to 20 percent of the mean rather than “within 20 percent” of the mean. 86 FR 20053, 20063.

DOE received no comments on its proposal. In this final rule, DOE amends section 3.8.2 of appendix O, consistent with the proposal in the April 2021 NOPR, to clarify that the standard deviation must be less than or equal to 20 percent of the mean as the determining factor for whether the cyclic condensate mass collection must be performed for three cycles or six cycles.

5. Other Vented Heater Topics

a. Determination of Balance Point Temperature, Heating Load Fractions, and Average Outdoor Temperature

In section 4.1.10 of appendix O, titled “Steady-state efficiency,” the balance point temperature (T_c)¹³ can be determined either with an equation or using the values provided in Table 3 of appendix O. The two options may not yield the exact same result because Table 3 provides a single balance point temperature value for a range of heat output ratios (R), while the equation provides a specific value for each heat output ratio. In other words, to use Table 3, first the heat output ratio is determined, then the corresponding range in Table 3 is selected to identify the balance point temperature for units with heat output ratios in the given range. To use the equation method, however, the heat output ratio is plugged into the equation, and balance point temperature is calculated. Similarly, values for the fraction of the heating load and average outdoor temperature at the reduced and maximum operating modes (variables

¹³ The “balance point temperature” is defined in section 4 of Appendix O and represents a temperature used to apportion the annual heating load between the reduced input cycling mode and either the modulating mode or maximum input cycling mode.

X_1 , X_2 , T_{OA} , and T_{OA}^*) are determined using either Table 3, or for T_{OA} and T_{OA}^* , Figure 1 of appendix O (which provides a graph showing T_{OA} and T_{OA}^* variables for any balance point temperature between 16 °F and 62 °F) and, for X_1 and X_2 , Figure 2 of appendix O (which provides a graph showing variables X_1 and X_2 for any balance point temperature between 0 °F and 62 °F). In the April 2021 NOPR, DOE noted that Table 3, Figure 1, and Figure 2 may yield different results because Table 3 provides discreet values for X_1 , X_2 , T_{OA} , and T_{OA}^* , whereas Figure 1 and Figure 2 provide continuous graphical curves for determining the relevant variables. 86 FR 20053, 20064. DOE further discussed in the April 2021 NOPR that it had reviewed test data to estimate the impact of the different methods for determining the value of variables on the measured AFUE value and found that the different methods resulted in a difference on the order of hundredths of a percentage point of AFUE, which DOE tentatively concluded would not be likely to affect the measured AFUE in most cases when rounded to a whole number. *Id.* Therefore, in the April 2021 NOPR, DOE did not propose any changes to the test method related to these issues. *Id.*

DOE did not receive any comments on these issues in response to the April 2021 NOPR; therefore, DOE is not adopting any changes regarding them.

b. Default Jacket Loss Value for Vented Floor Furnaces

The test procedure for vented floor furnaces requires the measurement of jacket losses when determining the AFUE. *See* section 3.2, appendix O. In the NOPR published in the *Federal Register* on October 24, 2013 as part of the most recent previous test procedure rulemaking for DHE (resulting in a final rule published on January 6, 2015 (the “January 2015 final rule”; 80 FR 792), DOE proposed an optional use of a default jacket loss value of 1 percent for vented floor furnaces, as an alternative to performing a jacket loss test. 78 FR 63410, 63415 (Oct. 24, 2013). In the January 2015 final rule, DOE decided not to adopt the 1 percent default jacket loss value for vented floor furnaces after reviewing test data that revealed an average jacket loss of 3.05 percent. 80 FR 792, 794 (Jan. 6, 2015).

In the April 2021 NOPR, DOE did not propose a default jacket loss value, stating its tentative conclusion that a default jacket loss value for vented floor furnaces would provide less representative ratings than the existing test method, which requires measurement of the jacket loss in floor furnaces. 86 FR 20053, 20064

NEEA and the Joint Advocates expressed support for continuing to measure jacket losses, rather than including a default value, stating that this would provide the most accurate representation of energy use and may encourage manufacturers to develop technology that further minimizes jacket losses. (NEEA, No. 16 at p. 2; Joint Advocates, No. 13 at p. 1)

Consistent with the April 2021 NOPR, DOE is not amending section 3.2 of appendix O to allow for a default jacket loss factor for floor furnaces.

c. Radiation Shielding

Sections 2.6.1, 2.6.2, and 2.9 of appendix O require that radiation shields be used to protect thermocouples that could receive direct radiation from the fire. However, no instruction was given on how to determine if a thermocouple could receive direct radiation from the fire, and if so, what type of radiation shielding would be required.

In the April 2021 NOPR, DOE proposed to require that all thermocouples be shielded from the fire if there is a direct line of sight between the fire and the thermocouple. Further, DOE proposed that if radiation shielding is required, then a radiation shield meeting the material and minimum thickness requirements stated in Section 8.14.1 of ANSI Z21.86-2016 shall be used. 86 FR 20053, 20065.

DOE received no comments on its proposal. In this final rule, DOE amends sections 2.6.1, 2.6.2, and 2.9 of appendix O, consistent with the proposal from the April 2021 NOPR, to require that all thermocouples be shielded from the fire if there is a direct line of sight between the fire and the thermocouple; and if radiation shielding is required, then the radiation shield must meet the material and minimum thickness requirements stated in Section 8.14.1 of ANSI Z21.86-2016.

d. Standing Pilot Light Energy

In response to a notice of proposed determination (“NOPD”) not to amend energy conservation standards for DHE published on December 1, 2020 (85 FR 77017), the Joint Advocates urged DOE to address the pilot light energy consumption for both vented and unvented heaters, noted that the test procedures (*i.e.*, appendix G and appendix O) do not require measurement of the pilot light energy input rate for vented heater models that instruct the user on how to turn the pilot light off, and stated that this instruction does little to reduce the operating hours of standing pilot lights in practice. (EERE-2019-BT-STD-0002: Joint Advocates, No. 16 at p. 1) No such comments were submitted on the April 2021 NOPR; however, DOE will respond to the Joint Advocates' comments in this document.

DOE addresses similar comments regarding appendix G received in response to the April 2021 NOPR in section III.C.2 of this document. Regarding appendix O, similar to the requirement for unvented heaters discussed previously, DOE notes that section 3.5 requires measurement of the standing pilot input rate for all vented heaters that are not manually controlled heaters for which the pilot light is designed to be turned off by the user when the heater is not in use (that is, turning the control to the OFF position will shut off the gas supply to burner(s) and to the pilot light). This provision applies only to manually controlled heaters that operate by the consumer physically turning the unit on and off when heating is desired, and does not apply to heaters that operate with a thermostat or other automatic means of control.

DOE did not propose any changes to section 3.5 of appendix O in the April 2021 NOPR. DOE does not have, and has not been presented with, sufficient data to determine whether a significant number of vented heater consumers leave the standing pilot light on during the non-heating season. As a result, DOE lacks data at this time regarding the operational hours of the pilot in off mode and the percentage of consumers that do not turn their pilot lights off during the non-heating seasons, which would be needed for DOE to

incorporate a representative measure of off mode energy use in the test procedure.

Therefore, DOE is maintaining the existing provisions in appendix O regarding the measurement of the pilot light energy input rate for vented heater models.

e. Draft Factors for Models with No Measurable Airflow

Section 3.6.1 of appendix O specifies that for units with no measurable airflow through the unit when not in heating mode (as determined by a smoke stick test defined in section 3.6.2 of appendix O), a default value of 0.05 may be used for both the off-cycle draft factor for flue gas flow (D_F) and power burner draft factor (D_P).

In the April 2021 NOPR, DOE noted its prior request for information in the February 2019 RFI regarding whether models using condensing or induced draft technology are always capable of meeting the criteria required to use the default draft factors of 0.05 and whether such models should automatically be considered to have no measurable airflow, and, thus, be allowed to use the defined value of 0.05 for D_F and D_P . 86 FR 20053, 20062. However, DOE did not propose the use of the default D_F and D_P values for condensing and induced draft vented heaters without first performing the test in section 3.6.2 of appendix O to confirm that there is no measurable airflow. *Id.* DOE tentatively concluded that the existing provisions in the test procedure for ensuring there is no airflow through the unit when not in heating mode before allowing the default draft factors are appropriate, particularly since the smoke stick test was not identified as overly burdensome by stakeholders or during DOE's testing. Further verification of no airflow ensures that representative draft factors are applied during testing. *Id.*

DOE received no comments in response to its tentative conclusions in the April 2021 NOPR. As such, DOE has concluded that the existing provisions in the test procedure for ensuring there is no airflow through the unit when not in heating mode before allowing the default draft factors are appropriate.

E. Performance and Utility

DHE provides space heating (heated air) directly to the consumer's living space without the use of duct connections. Also relevant to DHE may be the ability to provide "quiet" operation, non-heating air circulation, and space humidification.

In the April 2021 NOPR, DOE did not propose any changes to the test procedure related to performance and utility, and tentatively determined that the proposed changes to appendix O would not affect performance or utility. 86 FR 20053, 20065. DOE sought comment and data on whether the DHE test method affects DHE performance or utility, specifically including whether there are impacts on features such as air circulation and space humidification.

DOE received no comments on its proposal. DOE has determined that the amendments adopted in this final rule do not affect performance and utility of DHE.

F. Test Procedure Costs, Harmonization, and Other Topics

1. Test Procedure Costs and Impact

EPCA requires that test procedures proposed by DOE not be unduly burdensome to conduct. (42 U.S.C. 6293(b)(3)) In this final rule, DOE amends the existing test procedures for DHE (including both unvented and vented heaters) by updating definitions regarding unvented and vented heaters, incorporating by reference the most recent versions of several industry standards, explicitly specifying the operational mode for testing units with multiple automatic operational modes, stating the required input rate for the cyclic condensate collection test, allowing the use of manufacturer-specified values for gas supply pressure in certain circumstances, aligning the tolerance on the regulator outlet temperature with other DOE test procedures and the tolerance on the specific gravity of natural gas and propane with industry standards, providing an option to use fewer thermocouples for measuring the flue gas temperature in models with small flues, clarifying instructions for cyclic condensate mass measurements, and clarifying when radiation shielding is necessary. DOE has determined

that the amendments adopted in this final rule will not be unduly burdensome for manufacturers to conduct, will not change test burden for manufacturers, and will not increase testing costs.

Specifically, this final rule amends certain definitions of unvented heaters. These definitional changes provide greater consistency and do not affect the applicability of the test procedures or classification of any unvented heaters. As a result, the definitional changes will not require additional testing or impact testing costs.

This final rule updates the industry consensus standards incorporated by reference to the most recent versions of those test methods. All of the updated industry consensus standards, except ANSI/ASHRAE 103-2017, do not contain any significant changes in the sections referenced in the DOE test procedures for DHE. For ANSI/ASHRAE 103, the 2017 version differs from the 2007 version referenced in the DOE test procedure in relation to the oil pressure measurement error allowance and the post-purge time for applying default draft factor values. DOE is adopting the updated standard with modification to retain the oil pressure measurement error allowance and removing mentions of sections 8.8.3 and 9.10 within section 3.6.2.4.2 of appendix O, which refers to the maximum post-purge time for applying default draft factor values from the previously referenced 2007 version of the standard. These two revisions were the only significant differences between the 2007 and 2017 versions that would potentially impact testing of vented heaters. These amendments will not result in any additional burden or costs, as manufacturers are already complying with the oil pressure measurement error allowance provisions under the previous test procedure, and all the information stated in Section 8.8.3 of ANSI/ASHRAE 103-2007 is already stated in sections 3.6.1 and 3.6.2 of appendix O.

DOE is adopting amendments to specify that models with multiple automatic operational modes are to be tested in the default mode (or similarly named mode identified for normal operation). If a default mode is not defined in the product literature, the model

shall be tested in the mode that the equipment operates in as shipped from the manufacturer. As discussed, DOE did not identify any models currently on the market that are capable of multiple automatic operation modes. Thus, DOE concludes that this change will not require additional testing, nor will it impact testing costs.

DOE is amending appendix O to explicitly state the required input rate for the cyclic condensate collection test in section 3.8.2. The input rate instruction is identical to the instruction in Section 9.8 of ANSI/ASHRAE 103-2007, which was the industry test procedure on which the cyclic condensate collection test in section 3.8.2 was based. DOE notes this instruction is also included in the most recent version of ANSI/ASHRAE 103-2017. DOE concludes that because the input rate is not specified in DOE's current test procedure, but is explicitly stated in the industry test method, manufacturers are already testing as instructed by the industry test method. Therefore, this change will not require additional testing, nor would it impact testing costs.

DOE is amending appendix O to allow for use of manufacturer-specified gas inlet pressure ranges when the required input rating (*i.e.*, the nameplate input rating ± 2 percent) cannot be achieved at 7–10 inches water column, as previously required in appendix O. Aside from the tested unit that presented this issue, DOE is unaware of this issue more broadly occurring in manufacturer testing. Were this issue to occur, a valid test as prescribed by the test procedure could not be performed, and a manufacturer would need to seek a waiver from the test procedure under 10 CFR 430.27. DOE has not received any such waivers. As such, this amendment will not require retesting of units on the market and is not expected to impact test burden.

DOE is also adding a tolerance on the regulator outlet temperature to be within the greater of ± 10 percent of the manufacturer-specified manifold pressure or ± 0.2 inches water column. This tolerance is consistent with other DOE test procedures and is not expected to require retesting of units on the market or to impact test burden.

DOE is adding specifications that the specific gravity of natural gas be between 0.57 and 0.70 and of propane gas be between 1.522 and 1.574. These ranges include the previously required values and align with the industry's required ranges as stated in Annex G of ANSI Z21.86-2016. As such, these changes will not require retesting of units on the market and are not expected to impact test burden.

DOE is also allowing the testing agency to determine whether to use nine or five thermocouples when testing models with small (2-inch or less diameter) flues. In models where nine thermocouples restrict the flow to the point of causing the unit to operate outside of the allowable test and/or operational conditions (such as the maximum outlet air temperature), a test meeting all the required test conditions cannot be completed. Therefore, for impacted models, this change will allow testing to the required test conditions to be conducted, which are designed to produce results representative of a typical average use cycle. DOE has determined that performing a test with five thermocouples instead of nine will impose no additional testing costs.

DOE is clarifying the calculation for the allowable variance of the condensate mass measured during the cyclic condensate test when determining whether to conduct three cycles or six. The amended wording does not change the intent of the test or the test requirements, nor will it have an impact on test cost.

Finally, DOE is clarifying when thermocouple radiation shielding is necessary to install and, when shielding is necessary, providing additional specification to ensure that appropriate shielding materials are used. Radiation shielding requirements were already included in the previous test procedure, and the amendments do not change the intent of the test or the test requirements, nor will they have an impact on test cost.

In summary, DOE has determined that manufacturers will be able to rely on data generated under the previous test procedure and that retesting will not be necessary as a result of the amendments adopted by this final rule.

2. Harmonization with Industry Consensus Standards

Appendices G and O incorporate by reference certain provisions of numerous industry standards. Both appendices incorporate by reference IEC 62301 (Edition 2.0, 2011-01), which provides methods for measuring electrical standby mode and off mode power consumption. Appendix O also incorporates by reference ANSI/ASHRAE 103, which is a test method for determining the annual fuel utilization efficiency of residential central furnaces and boilers; ANSI Z21.86, which is a standard for construction and safety performance of vented gas space heating appliance; ASTM D-2156, which is a standard for determining smoke density; and UL 729, UL 730, and UL 896, which are standards pertaining to the installation of oil-fired vented heaters. The only industry standard referenced in appendix G is IEC 62301. As discussed in section III.B of this document, this final rule incorporates by reference the most recent versions of the referenced industry standards.

G. Effective and Compliance Dates

The effective date for the adopted test procedure amendments is 30 days after publication of this final rule in the *Federal Register*. EPCA prescribes that all representations of energy efficiency and energy use, including those made on marketing materials and product labels, must be made in accordance with an amended test procedure, beginning 180 days after publication of the final rule in the *Federal Register*. (42 U.S.C. 6293(c)(2)) EPCA provides an allowance for individual manufacturers to petition DOE for an extension of the 180-day period if the manufacturer may experience undue hardship in meeting the deadline. (42 U.S.C. 6293(c)(3)) To receive such an extension, petitions must be filed with DOE no later than 60 days before the end of the 180-day period and must detail how the manufacturer will experience undue hardship. (*Id.*)

IV. Procedural Issues and Regulatory Review

A. Review Under Executive Order 12866

The Office of Management and Budget (“OMB”) has determined this test procedure rulemaking does not constitute a “significant regulatory action” under section 3(f) of Executive Order 12866, Regulatory Planning and Review, 58 FR 51735 (Oct. 4, 1993). Accordingly, this action was not subject to review under the Executive order by the Office of Information and Regulatory Affairs (“OIRA”) in OMB.

B. Review Under the Regulatory Flexibility Act

The Regulatory Flexibility Act (5 U.S.C. 601 *et seq.*) requires preparation of a final regulatory flexibility analysis (“FRFA”) for any final rule where the agency was first required by law to publish a proposed rule for public comment, unless the agency certifies that the rule, if promulgated, will not have a significant economic impact on a substantial number of small entities. As required by Executive Order 13272, “Proper Consideration of Small Entities in Agency Rulemaking,” 67 FR 53461 (Aug. 16, 2002), DOE published procedures and policies on February 19, 2003, to ensure that the potential impacts of its rules on small entities are properly considered during the DOE rulemaking process. 68 FR 7990. DOE has made its procedures and policies available on the Office of the General Counsel’s website: www.energy.gov/gc/office-general-counsel.

The Small Business Administration (“SBA”) considers a business entity to be a small business, if, together with its affiliates, it employs less than a threshold number of workers specified in 13 CFR part 121. The size standards and codes are established by the 2017 North American Industry Classification System (“NAICS”). DHE manufacturers are classified under NAICS code 333414, “Heating Equipment (except Warm Air Furnaces) Manufacturing.” The SBA sets a threshold of 500 employees or fewer for an entity to be considered as a small business. DOE used available public information to identify potential small manufacturers of the covered product. DOE accessed the Compliance System

Management System's Compliance Certification Database and AHRI's certified product directory to create a list of companies that import or otherwise manufacture DHE covered by this proposal. Using these sources, DOE identified a total of four manufacturers of DHE. Of these manufacturers, two are potential small domestic businesses. In April 2021 NOPR, DOE concluded that the impacts of the proposed test procedure amendments would not have a "significant economic impact on a substantial number of small entities," and that the preparation of an initial regulatory flexibility analysis ("IRFA") was not warranted. DOE transmitted the certification of its determination and supporting statement of factual basis to the Chief Counsel for Advocacy of the Small Business Administration for review under 5 U.S.C 605(b).

Between the publication of the April 2021 NOPR and this final rule, one small business manufacturer purchased another small business manufacturer's vented heater brand. It is unclear at this time whether the combined business remains below the SBA's headcount threshold of 500 people to be considered a small business. Due to the nature of this final rule, which generally updates the incorporations by reference to the latest version of applicable industry consensus standards (which saw no substantive changes to the relevant provisions) and makes a number of clarifications and minor modifications designed to reduce burden, the Department has determined that this final rule will not impose a significant burden on small manufacturers who produce this specific type of product.

More specifically, in this document, DOE added the following changes to the test procedure for unvented and vented heaters, as well as several associated changes to definitions at 10 CFR 430.2. First, to ensure consistent use and application of the test procedure, DOE: updates the definitions of "floor electric heater," "primary heater," "unvented gas heater," "unvented home heating equipment," "unvented oil heater," "vented home heating equipment," and "vented room heater"; updates the terms "primary heater" and "supplementary heater" to "primary electric heater" and "supplementary electric heater,"

respectively; maintains the existing oil pressure measurement error value in the test procedure; explicitly states the regulator outlet pressure and specific gravity tolerances for the gas supply; and clarifies the wording of the cyclic condensate collection test in the calculation of the allowable variance in condensate mass measurements. Second, to align with the most recent industry consensus standards, DOE: updates the references to the industry consensus standards to the most recent versions; clarifies the required input rate for the cyclic condensate collection tests; and explicitly states the methods to appropriately shield thermocouples from radiation. Third, to ensure the representativeness of the test procedure, DOE: explicitly states the operational mode for testing vented heaters with multiple automatic operation modes; allows for use of manufacturer-specified gas inlet pressure range when the required input rating cannot be reached; and provides an option to use five, rather than nine, thermocouples for the thermocouple grid in models with small (2-inch diameter or less) flues.

All changes are either clarifications to ensure consistent use and application (which does not affect the results of the test procedure or how the test procedure is run) or amendments that ensure the representativeness of the test procedure as compared to products installed in the field. These amendments are consistent with the most recent industry consensus standards.

As stated, DOE has reviewed this final rule to amend the test procedures for DHE under the provisions of the Regulatory Flexibility Act and the procedures and policies published on February 19, 2003, and the Department has determined that this rulemaking will not have any cost impact. Therefore, DOE concludes that the impacts of the test procedure amendments in this final rule will not have a “significant economic impact on a substantial number of small entities,” and that the preparation of an FRFA is not warranted. DOE has submitted a certification and supporting statement of factual basis to the Chief

Counsel for Advocacy of the Small Business Administration for review under 5 U.S.C. 605(b).

C. Review Under the Paperwork Reduction Act of 1995

Manufacturers of DHE must certify to DOE that their products comply with any applicable energy conservation standards. To certify compliance, manufacturers must first obtain test data for their products according to the DOE test procedures, including any amendments adopted for those test procedures. DOE has established regulations for the certification and recordkeeping requirements for all covered consumer products and commercial equipment, including DHE. (*See generally* 10 CFR part 429.) The collection-of-information requirement for the certification and recordkeeping is subject to review and approval by OMB under the Paperwork Reduction Act (“PRA”). This requirement has been approved by OMB under OMB control number 1910-1400. Public reporting burden for the certification is estimated to average 35 hours per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information.

Notwithstanding any other provision of the law, no person is required to respond to, nor shall any person be subject to a penalty for failure to comply with, a collection of information subject to the requirements of the PRA, unless that collection of information displays a currently valid OMB Control Number.

D. Review Under the National Environmental Policy Act of 1969

In this document, DOE finalizes test procedures to measure the rated output and implement energy conservation standards for DHE. DOE has determined that this rule falls into a class of actions that are categorically excluded from review under the National Environmental Policy Act of 1969 (42 U.S.C 4321 *et seq.*) and DOE’s implementing regulations at 10 CFR part 1021. Specifically, DOE has determined that adopting test procedures for measuring energy efficiency of consumer products and industrial equipment

is consistent with activities identified in 10 CFR part 1021, appendix A to subpart D, A5 and A6. Accordingly, neither an environmental assessment nor an environmental impact statement is required.

E. Review Under Executive Order 13132

Executive Order 13132, “Federalism,” 64 FR 43255 (Aug. 4, 1999), imposes certain requirements on agencies formulating and implementing policies or regulations that preempt State law or that have federalism implications. The Executive order requires agencies to examine the constitutional and statutory authority supporting any action that would limit the policymaking discretion of the States and to carefully assess the necessity for such actions. The Executive order also requires agencies to have an accountable process to ensure meaningful and timely input by State and local officials in the development of regulatory policies that have federalism implications. On March 14, 2000, DOE published a statement of policy describing the intergovernmental consultation process it will follow in the development of such regulations. 65 FR 13735. DOE examined this final rule and determined that it will not have a substantial direct effect on the States, on the relationship between the national government and the States, or on the distribution of power and responsibilities among the various levels of government. EPCA governs and prescribes Federal preemption of State regulations as to energy conservation for the products that are the subject of this final rule. States can petition DOE for exemption from such preemption to the extent, and based on criteria, set forth in EPCA. (42 U.S.C. 6297(d)) No further action is required by Executive Order 13132.

F. Review Under Executive Order 12988

Regarding the review of existing regulations and the promulgation of new regulations, section 3(a) of Executive Order 12988, “Civil Justice Reform,” 61 FR 4729 (Feb. 7, 1996), imposes on Federal agencies the general duty to adhere to the following requirements: (1) eliminate drafting errors and ambiguity; (2) write regulations to minimize

litigation; (3) provide a clear legal standard for affected conduct rather than a general standard; and (4) promote simplification and burden reduction. Section 3(b) of Executive Order 12988 specifically requires that Executive agencies make every reasonable effort to ensure that the regulation (1) clearly specifies the preemptive effect, if any; (2) clearly specifies any effect on existing Federal law or regulation; (3) provides a clear legal standard for affected conduct while promoting simplification and burden reduction; (4) specifies the retroactive effect, if any; (5) adequately defines key terms; and (6) addresses other important issues affecting clarity and general draftsmanship under any guidelines issued by the Attorney General. Section 3(c) of Executive Order 12988 requires executive agencies to review regulations in light of applicable standards in sections 3(a) and 3(b) to determine whether they are met or it is unreasonable to meet one or more of them. DOE has completed the required review and determined that, to the extent permitted by law, this final rule meets the relevant standards of Executive Order 12988.

G. Review Under the Unfunded Mandates Reform Act of 1995

Title II of the Unfunded Mandates Reform Act of 1995 (“UMRA”) requires each Federal agency to assess the effects of Federal regulatory actions on State, local, and Tribal governments and the private sector. Pub. L. 104-4, sec. 201 (codified at 2 U.S.C. 1531). For a regulatory action resulting in a rule that may cause the expenditure by State, local, and Tribal governments, in the aggregate, or by the private sector of \$100 million or more in any one year (adjusted annually for inflation), section 202 of UMRA requires a Federal agency to publish a written statement that estimates the resulting costs, benefits, and other effects on the national economy. (2 U.S.C. 1532(a), (b)) The UMRA also requires a Federal agency to develop an effective process to permit timely input by elected officers of State, local, and Tribal governments on a proposed “significant intergovernmental mandate,” and requires an agency plan for giving notice and opportunity for timely input to potentially affected small governments before establishing any requirements that might significantly or uniquely affect

small governments. On March 18, 1997, DOE published a statement of policy on its process for intergovernmental consultation under UMRA. 62 FR 12820; also available at www.energy.gov/gc/office-general-counsel. DOE examined this final rule according to UMRA and its statement of policy and determined that the rule contains neither an intergovernmental mandate, nor a mandate that may result in the expenditure of \$100 million or more in any year, so these requirements do not apply.

H. Review Under the Treasury and General Government Appropriations Act, 1999

Section 654 of the Treasury and General Government Appropriations Act, 1999 (Pub. L. 105-277) requires Federal agencies to issue a Family Policymaking Assessment for any rule that may affect family well-being. This final rule will not have any impact on the autonomy or integrity of the family as an institution. Accordingly, DOE has concluded that it is not necessary to prepare a Family Policymaking Assessment.

I. Review Under Executive Order 12630

DOE has determined, under Executive Order 12630, “Governmental Actions and Interference with Constitutionally Protected Property Rights” 53 FR 8859 (March 18, 1988), that this regulation will not result in any takings that might require compensation under the Fifth Amendment to the U.S. Constitution.

J. Review Under Treasury and General Government Appropriations Act, 2001

Section 515 of the Treasury and General Government Appropriations Act, 2001 (44 U.S.C. 3516 note) provides for agencies to review most disseminations of information to the public under guidelines established by each agency pursuant to general guidelines issued by OMB. OMB’s guidelines were published at 67 FR 8452 (Feb. 22, 2002), and DOE’s guidelines were published at 67 FR 62446 (Oct. 7, 2002). Pursuant to OMB Memorandum M-19-15, Improving Implementation of the Information Quality Act (April 24, 2019), DOE published updated guidelines which are available at:

www.energy.gov/sites/prod/files/2019/12/f70/DOE%20Final%20Updated%20IQA%20Guide

lines%20Dec%202019.pdf. DOE has reviewed this final rule under the OMB and DOE guidelines and has concluded that it is consistent with applicable policies in those guidelines.

K. Review Under Executive Order 13211

Executive Order 13211, “Actions Concerning Regulations That Significantly Affect Energy Supply, Distribution, or Use,” 66 FR 28355 (May 22, 2001), requires Federal agencies to prepare and submit to OMB, a Statement of Energy Effects for any significant energy action. A “significant energy action” is defined as any action by an agency that promulgated or is expected to lead to promulgation of a final rule, and that (1) is a significant regulatory action under Executive Order 12866, or any successor order; and (2) is likely to have a significant adverse effect on the supply, distribution, or use of energy; or (3) is designated by the Administrator of OIRA as a significant energy action. For any significant energy action, the agency must give a detailed statement of any adverse effects on energy supply, distribution, or use if the regulation is implemented, and of reasonable alternatives to the action and their expected benefits on energy supply, distribution, and use.

This regulatory action is not a significant regulatory action under Executive Order 12866. Moreover, it would not have a significant adverse effect on the supply, distribution, or use of energy, nor has it been designated as a significant energy action by the Administrator of OIRA. Therefore, it is not a significant energy action, and, accordingly, DOE has not prepared a Statement of Energy Effects.

L. Review Under Section 32 of the Federal Energy Administration Act of 1974

Under section 301 of the Department of Energy Organization Act (Pub. L. 95–91; 42 U.S.C. 7101), DOE must comply with section 32 of the Federal Energy Administration Act of 1974, as amended by the Federal Energy Administration Authorization Act of 1977. (15 U.S.C. 788; “FEAA”) Section 32 essentially provides in relevant part that, where a proposed rule authorizes or requires use of commercial standards, the notice of proposed rulemaking must inform the public of the use and background of such standards. In addition, section

32(c) requires DOE to consult with the Attorney General and the Chairman of the Federal Trade Commission (“FTC”) concerning the impact of the commercial or industry standards on competition.

The modifications to the test procedure for DHE adopted in this final rule incorporates testing methods contained in certain sections of the following commercial standards: ASNI/ASHRAE 103-2017, ANSI Z21.86-2016, ASTM D2156-09 (R2018), IEC 62301 (Edition 2.0, 2011-01), UL 729-2016, UL 730-2016, and UL 897-2016. DOE has evaluated these standards and is unable to conclude whether it fully complies with the requirements of section 32(b) of the FEAA (*i.e.*, whether it was developed in a manner that fully provides for public participation, comment, and review.) DOE has consulted with both the Attorney General and the Chairman of the FTC about the impact on competition of using the methods contained in these standards and has received no comments objecting to their use.

M. Congressional Notification

As required by 5 U.S.C. 801, DOE will report to Congress on the promulgation of this rule before its effective date. The report will state that it has been determined that the rule is not a "major rule" as defined by 5 U.S.C. 804(2).

N. Description of Materials Incorporated by Reference

In this final rule, DOE incorporates by reference the following test standards:

(1) The test standard published by ASHRAE, titled “Method of Testing for Annual Fuel Utilization Efficiency of Residential Central Furnaces and Boilers,” ANSI/ASHRAE 103-2017. ANSI/ASHRAE 103-2017 is an industry-accepted test procedure for determining the annual fuel utilization efficiency of consumer furnaces and boilers. Specifically, the test procedure amendments adopted by this final rule reference sections of that industry consensus standard regarding test set-up for oil-fueled DHE (including instrumentation and measurement descriptions for oil burner adjustments), and instructions on calculating jacket

losses in vented floor heaters and calculations for draft factors. Copies of ANSI/ASHRAE 103-2017 can be obtained from ASHRAE, 180 Technology Parkway NW, Peachtree Corners, GA 30092, (800) 527-4723 or (404) 636-8400, or online at: www.ashrae.org.

(2) The test standard approved by ANSI, titled “Vented Gas-fired Space Heating Appliances,” ANSI Z21.86-2016. ANSI Z21.86 is an industry-accepted test procedure for vented gas-fired space heating appliances. Specifically, the test procedure amendments adopted by this final rule reference sections of that industry consensus standard regarding the set-up specifications for vented wall DHE, instructions for gas usage other than natural gas or propane, instructions for measuring discharge temperatures of forced air, vented, wall DHE, and descriptions of thermocouple installation in gas-fueled, vented DHEs. Copies of ANSI Z21.86-2016 can be obtained from ANSI, 25 W. 43rd Street, 4th Floor, New York, NY 10036, (212) 642-4900, or online at: www.ansi.org.

(3) The test standard published by ASTM, titled “Standard Test Method for Smoke Density in Flue Gases from Burning Distillate Fuels,” ASTM D2156-09 (R2018). ASTM D2156 is an industry-accepted test procedure for measuring smoke density in flue gases from burning distillate fuels. Specifically, the test procedure amendments adopted by this final rule reference sections of that industry consensus standard regarding providing smoke density levels which are measured during for the steady-state test. Copies of ASTM D2156-09 (R2018) can be obtained from ASTM, 100 Barr Harbor Drive, P.O. Box C700, West Conshohocken, PA 19428-2959 or online at: www.astm.org.

(4) The test standard published by IEC, titled “Household electrical appliances—Measurement of standby power,” IEC 62301 (Edition 2.0, 2011-01). IEC 62301 is an industry-accepted test procedure for the measurement of standby power modes in household electrical appliances. Specifically, the test procedure amendments adopted by this final rule reference sections of that industry consensus standard regarding measurement of electrical standby mode and off mode power consumption. Copies of IEC 62301 (Second Edition) can

be obtained from the American National Standards Institute, 25 W. 43rd Street, 4th Floor, New York, NY 10036, (212) 642-4900, or online at: www.webstore.ansi.org.

(5)-(7) The test standards published by UL: “Standard for Safety for Oil-fired Floor Furnaces,” “Standard for Safety for Oil-fired Wall Furnaces,” and “Standard for Safety for Oil-burning Stoves,” UL 729-2016, UL 730-2016, and UL 896-2016, respectively. UL 729, UL 730, UL 896 are industry-accepted test procedures for oil-fired floor furnaces, oil-fired wall furnaces, and oil-burning stoves respectively. Specifically, the test procedure amendments adopted by this final rule reference sections of those industry consensus standards regarding vented floor and wall DHE test installation and instructions for flue and thermocouple installation for oil fueled, vented floor DHEs. Copies of UL 729-2016, UL 730-2016, and UL 896-2016 can be obtained from UL at 2600 NW. Lake Rd., Camas, WA 98607-8542 or online at: www.ul.com.

The Director of the Federal Register previously approved IEC 62301 (Edition 2.0, 2011-01) for incorporation by reference in the locations in which it appears in this rule’s regulatory text for 10 CFR part 430.

V. Approval of the Office of the Secretary

The Secretary of Energy has approved publication of this final rule.

List of Subjects in 10 CFR Part 430

Administrative practice and procedure, Confidential business information, Energy conservation, Household appliances, Imports, Incorporation by reference, Intergovernmental relations, Reporting and recordkeeping requirements, Small businesses.

Signing Authority

This document of the Department of Energy was signed on May 10, 2022, by Kelly J. Speakes-Backman, Principal Deputy Assistant Secretary for Energy Efficiency and Renewable Energy, pursuant to delegated authority from the Secretary of Energy. That document with the original signature and date is maintained by DOE. For administrative purposes only, and in compliance with requirements of the Office of the Federal Register, the undersigned DOE Federal Register Liaison Officer has been authorized to sign and submit the document in electronic format for publication, as an official document of the Department of Energy. This administrative process in no way alters the legal effect of this document upon publication in the *Federal Register*.

Signed in Washington, DC, on May 10, 2022.

Treena V. Garrett
Federal Register Liaison Officer,
U.S. Department of Energy

For the reasons stated in the preamble, DOE amends part 430 of Chapter II of Title 10, Code of Federal Regulations as set forth below:

PART 430 – ENERGY CONSERVATION PROGRAM FOR CONSUMER PRODUCTS

1. The authority citation for part 430 continues to read as follows:

Authority: 42 U.S.C. 6291-6309; 28 U.S.C. 2461 note.

2. Section 430.2 is amended by:

a. Revising the definitions for “Electric heater”, “Floor electric heater”, “Primary heater”, “Supplementary heater”, and “Unvented gas heater”;

b. Removing the definition of “Unvented home heating equipment” and adding, in alphabetical order, the definition of “Unvented home heating equipment or unvented heater”; and

c. Revising the definitions of “Unvented oil heater”, “Vented home heating equipment or vented heater”, and “Vented room heater”.

The revisions and addition read as follows:

§430.2 Definitions.

* * * * *

Electric heater means an electric appliance which is a class of unvented home heating equipment in which heat is generated from electrical energy and dissipated by convection and radiation and includes baseboard electric heaters, ceiling electric heaters, floor electric heaters, portable electric heaters, and wall electric heaters.

* * * * *

Floor electric heater means an electric heater which is intended to be recessed in a floor, and which transfers heat by radiation and/or convection (either natural or forced).

* * * * *

Primary electric heater means an electric heater that is the principal source of heat for a structure and includes baseboard electric heaters, ceiling electric heaters, floor electric heaters, and wall electric heaters.

* * * * *

Supplementary electric heater means an electric heater that provides heat to a space in addition to that which is supplied by a primary electric heater and includes portable electric heaters.

* * * * *

Unvented gas heater means a class of unvented home heating equipment which is a self-contained, free-standing, nonrecessed gas-burning appliance that furnishes heated air by gravity or fan circulation.

Unvented home heating equipment or unvented heater means a class of home heating equipment, not including furnaces, designed to furnish heated air to a space proximate to such heater, directly from the heater, without inlet duct connections and without exhaust venting, and includes: electric heater, unvented gas heater, and unvented oil heater.

Unvented oil heater means a class of unvented home heating equipment which is a self-contained, free-standing, nonrecessed oil-burning appliance that furnishes heated air by gravity or fan circulation.

* * * * *

Vented home heating equipment or vented heater means a class of home heating equipment, not including furnaces, designed to furnish heated air to a space proximate to such heater, directly from the heater, without inlet duct connections (except that boots not to exceed 10 inches beyond the casing may be permitted), and with exhaust venting, and includes: vented wall furnace, vented floor furnace, and vented room heater.

Vented room heater means a self-contained, free standing, nonrecessed, vented heater for furnishing heated air to the space in which it is installed. The vented room heater

supplies heated air circulated by gravity or by a fan directly into the space to be heated through openings in the casing.

* * * * *

3. Section 430.3 is amended by:

- a. Removing and reserving paragraph (e)(25);
- b. Revising paragraphs (g) introductory text and (g)(16);
- c. Redesignating paragraphs (g)(17) and (18) as (g)(18) and (19), respectively;
- d. Adding new paragraph (g)(17);
- e. Revising paragraph (j)(1) and adding paragraph (j)(3);
- f. Redesignating paragraphs (k) through (v) as paragraphs (l) through (w) and adding new paragraph (k); and
- g. Revising newly redesignated paragraphs (w)(1) through (3).

The revisions and additions read as follows:

§430.3 Materials incorporated by reference.

* * * * *

(g) *ASHRAE*. American Society of Heating, Refrigerating, and Air-Conditioning Engineers, Inc., 180 Technology Parkway NW, Peachtree Corners, GA 30092; (800) 527-4723 or (404) 636-8400; *www.ashrae.org*.

* * * * *

(16) ANSI/ASHRAE Standard 103-2007 (“ASHRAE 103-2007”), Method of Testing for Annual Fuel Utilization Efficiency of Residential Central Furnaces and Boilers, ANSI-approved March 25, 2008; IBR approved for appendix AA to subpart B.

(17) ANSI/ASHRAE Standard 103-2017 (“ASHRAE 103-2017”), Method of Testing for Annual Fuel Utilization Efficiency of Residential Central Furnaces and Boilers, ANSI-approved July 3, 2017; IBR approved for appendix O to subpart B.

* * * * *

(j) * * *

(1) ASTM D2156-09 (“ASTM D2156”), Standard Test Method for Smoke Density in Flue Gases from Burning Distillate Fuels, ASTM-approved December 1, 2009; IBR approved for appendix E to subpart B.

* * * * *

(3) ASTM D2156-09 (Reapproved 2018) (“ASTM D2156-09 (R2018)”), Standard Test Method for Smoke Density in Flue Gases from Burning Distillate Fuels, approved October 1, 2018; IBR approved for appendix O to subpart B.

(k) *Canadian Standards Association (CSA)*. CSA Group, 178 Rexdale Blvd, Toronto, ON, Canada M9W 1R3, 1-800-463-6727 or 416-747-4044, www.csagroup.org.

(1) ANSI Z21.86-2016 · CSA 2.32-2016 (“ANSI Z21.86-2016”), Vented gas-fired space heating appliances, ANSI-approved December 21, 2016; IBR approved for appendix O to subpart B.

(2) [Reserved]

* * * * *

(w) * * *

(1) UL 729 (“UL 729-2016”), Standard for Safety for Oil-Fired Floor Furnaces, Sixth Edition, dated August 29, 2003, including revisions through November 22, 2016; IBR approved for appendix O to subpart B.

(2) UL 730 (“UL 730-2016”), Standard for Safety for Oil-Fired Wall Furnaces, Fifth Edition, dated August 29, 2003, including revisions through November 22, 2016; IBR approved for appendix O to subpart B.

(3) UL 896 (“UL 896-2016”), Standard for Safety for Oil-Burning Stoves, Fifth Edition, dated July 29, 1993; including revisions through November 22, 2016, IBR approved for appendix O to subpart B.

4. Appendix O to subpart B of part 430 is amended by:

- a. Revising the introductory note;
- b. Adding section 0; and
- c. Revising sections 2, 3.1.2, 3.2, 3.6.2.4.2, and 3.8.2.

The additions and revisions read as follows:

**APPENDIX O TO SUBPART B OF PART 430—UNIFORM TEST METHOD
FOR MEASURING THE ENERGY CONSUMPTION OF VENTED HOME
HEATING EQUIPMENT**

NOTE: Prior to **[INSERT DATE 180 DAYS AFTER DATE OF PUBLICATION IN THE FEDERAL REGISTER]**, representations with respect to the energy use or efficiency of vented home heating equipment, including compliance certifications, must be based on testing conducted in accordance with either this appendix as it now appears or appendix O as it appeared at 10 CFR part 430, subpart B revised as of January 1, 2021.

On and after **[INSERT DATE 180 DAYS AFTER DATE OF PUBLICATION IN THE FEDERAL REGISTER]**, representations with respect to energy use or efficiency of vented home heating equipment, including compliance certifications, must be based on testing conducted in accordance with this appendix.

0.0 Incorporation by Reference

DOE incorporated by reference in §430.3: ANSI Z21.86-2016; ASHRAE 103-2017; ASTM D2156-09 (R2018); IEC 62301; UL 729-2016; UL 730-2016; and UL 896-2016 in their entirety. However, only enumerated provisions of ANSI Z21.86-2016; ASHRAE 103-2017, UL 729-2016, UL 730-2016, and UL 896-2016 are applicable to this appendix, as follows:

0.1 ANSI Z21.86-2016

- (i) Section 5.2 – Test gases
- (ii) Section 9.1.3
- (iii) Section 11.1.3
- (iv) Section 11.7 – Temperature at discharge air opening and surface temperatures

0.2 ASHRAE 103-2017

- (i) Section 6 – INSTRUMENTS
- (ii) Section 8.2.2.3.1 – Oil Supply
- (iii) Section 8.6 – Jacket Loss Measurement
- (iv) Section 8.8.3 – Additional Optional Method of Testing for Determining
DP and DF for Furnaces and Boilers
- (v) Section 9.10 – Optional Test Procedures for Condensing Furnaces and Boilers that
Have no OFF-Period Flue Losses

0.3 UL 729-2016

- (i) Section 38.1 – Enclosure
- (ii) Section 38.2 – Chimney connector

0.4 UL 730-2016

- (i) Section 36.1 – Enclosure
- (ii) Section 36.2 – Chimney connector
- (iii) Sections 37.5.8 through 37.5.18

0.5 UL 896-2016

- (i) Section 37.1.2
- (ii) Section 37.1.3

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2.0 Testing conditions.

2.1 Installation of test unit.

2.1.1 Vented wall furnaces (including direct vent systems). Install non-direct vent gas fueled vented wall furnaces as specified in Section 11.1.3 of ANSI Z21.86-2016. Install direct vent gas fueled vented wall furnaces as specified in Section 9.1.3 of ANSI Z21.86-2016. Install oil-fueled vented wall furnaces as specified in Section 36.1 of UL 730-2016.

2.1.2 Vented floor furnaces. Install vented floor furnaces for test as specified in Section 38.1 of UL 729-2016.

2.1.3 Vented room heaters. Install vented room heaters for test in accordance with the manufacturer's installation and operations (I&O) manual provided with the unit.

2.2 Flue and stack requirements.

2.2.1 Gas fueled vented home heating equipment employing integral draft diverters and draft hoods (excluding direct vent systems). Attach to, and vertically above the outlet of gas-fueled vented home heating equipment employing draft diverters or draft hoods with vertically discharging outlets, a five (5) foot long test stack having a cross-sectional area the same size as the draft diverter outlet.

Attach to the outlet of vented heaters having a horizontally discharging draft diverter or draft hood outlet a 90-degree elbow, and a five (5) foot long vertical test stack. A horizontal section of pipe may be used on the floor furnace between the diverter and the elbow, if necessary, to clear any framing used in the installation. Use the minimum length of pipe possible for this section. Use stack, elbow, and horizontal section with same cross-sectional area as the diverter outlet.

2.2.2 Oil-fueled vented home heating equipment (excluding direct vent systems). Use flue connections for oil-fueled vented floor furnaces as specified in Section 38.2 of UL 729-2016, Section 36.2 of UL 730-2016 for oil-fueled vented wall furnaces, and Sections 37.1.2 and 37.1.3 of UL 896-2016 for oil-fueled vented room heaters.

2.2.3 Direct vent systems. Have the exhaust/air intake system supplied by the manufacturer in place during all tests. Test units intended for installation with a variety of vent pipe lengths with the minimum length recommended by the manufacturer in the I&O manual. Do not connect a heater employing a direct vent system to a chimney or induced draft source. Vent the gas solely on the provision for venting incorporated in the heater and the vent/air intake system supplied with it.

2.2.4 Condensing vented heater, additional flue requirements. The flue pipe installation must not allow condensate formed in the flue pipe to flow back into the unit. An initial downward slope from the unit's exit, an offset with a drip leg, annular collection rings, or drain holes must be included in the flue pipe installation without disturbing normal flue gas flow. Flue gases should not flow out of the drain with the condensate. For condensing vented heaters that do not include means for collection of condensate, a means to collect condensate must be supplied by the test lab for the purposes of testing.

2.3 Fuel supply.

2.3.1 Natural gas. For a gas-fueled vented heater, maintain the gas supply to the unit under test at an inlet test pressure immediately ahead of all controls at 7 to 10 inches water column. If the heater is equipped with a gas pressure regulator, maintain the regulator outlet pressure within the greater of ± 0.2 inches water column, or ± 10 percent, of the manufacturer-specified manifold pressure on the nameplate of the unit or in the I&O manual. Use natural gas having a specific gravity between 0.57 and 0.70 and a higher heating value within ± 5 percent of 1,025 Btu per standard cubic foot. Determine the actual higher heating value in Btu per standard cubic foot for the natural gas to be used in the test with an error no greater than one percent. If the burner cannot be adjusted to obtain a heat input rate of within ± 2 percent of the hourly Btu rating specified by the manufacturer on the nameplate of the unit or in the I&O manual, as required by section 2.4.1 of this appendix, maintain the gas supply to the unit under test at an inlet test pressure immediately ahead of all controls at any value within the range specified on the nameplate of the unit or in the I&O manual that results in a heat input rate of within ± 2 percent of the hourly Btu rating specified by the manufacturer on the nameplate of the unit or in the I&O manual.

2.3.2 Propane gas. For a propane-gas-fueled vented heater, maintain the gas supply to the unit under test at an inlet pressure of 11 to 13 inches water column. If the heater is equipped with a gas pressure regulator, maintain the regulator outlet pressure within the greater of \pm

0.2 inches water column, or ± 10 percent, of the manufacturer's specified manifold pressure on the nameplate of the unit or in the I&O manual. Use propane having a specific gravity between 1.522 and 1.574 and a higher heating value within ± 5 percent of 2,500 Btu per standard cubic foot. Determine the actual higher heating value in Btu per standard cubic foot for the propane to be used in the test. If the burner cannot be adjusted to obtain a heat input rate of within ± 2 percent of the hourly Btu rating specified by the manufacturer on the nameplate of the unit or in the I&O manual, as required by section 2.4.1 of this appendix, maintain the gas supply to the unit under test at an inlet test pressure immediately ahead of all controls at any value within the range specified on the nameplate of the unit or in the I&O manual that results in a heat input rate of within ± 2 percent of the hourly Btu rating specified by the manufacturer on the nameplate of the unit or in the I&O manual.

2.3.3 Other test gas. For vented heaters fueled by other test gases, use test gases with characteristics as described in Table 3 of Section 5.2 of ANSI Z21.86-2016. Use gases with a measured higher heating value within ± 5 percent of the values specified in Table 3 of Section 5.2 of ANSI Z21.86-2016. Determine the actual higher heating value of the gas used in the test with an error no greater than one percent.

2.3.4 Oil supply. For an oil-fueled vented heater, use No. 1 fuel oil (kerosene) for vaporizing-type burners and either No. 1 or No. 2 fuel oil, as specified by the manufacturer in the I&O manual provided with the unit, for mechanical atomizing type burners. Use test fuel conforming to the specifications given in Tables 2 and 3 of Section 8.2.2.3.1 of ASHRAE 103-2017. Measure the higher heating value of the test fuel within ± 1 percent.

2.3.5 Electrical supply. For auxiliary electric components of a vented heater, maintain the electrical supply to the test unit within ± 1 percent of the nameplate voltage for the entire test cycle. If a voltage range is used for nameplate voltage, maintain the electrical supply within ± 1 percent of the mid-point of the nameplate voltage range.

2.4 Burner adjustments.

2.4.1 Gas burner adjustments. Adjust the burners of gas-fueled vented heaters to their maximum Btu ratings at the test pressure specified in section 2.3 of this appendix. Correct the burner volumetric flow rate to 60 °F (15.6 °C) and 30 inches of mercury barometric pressure, set the fuel flow rate to obtain a heat rate of within ± 2 percent of the hourly Btu rating specified by the manufacturer on the nameplate of the unit or in the I&O manual, as measured after 15 minutes of operation, starting with all parts of the vented heater at room temperature. Set the primary air shutters in accordance with the manufacturer's recommendations on the nameplate of the unit or in the I&O manual to give a good flame at this adjustment. Do not allow the deposit of carbon during any test specified herein.

If a vent limiting means is provided on a gas pressure regulator, have it in place during all tests.

For gas-fueled heaters with modulating controls, adjust the controls to operate the heater at the maximum fuel input rate. Set the thermostat control to the maximum setting. Start the heater by turning the safety control valve to the “on” position. In order to prevent modulation of the burner at maximum input, place the thermostat sensing element in a temperature control bath which is held at a temperature below the maximum set point temperature of the control.

For gas-fueled heaters with modulating controls, adjust the controls to operate the heater at the reduced fuel input rate. Set the thermostat control to the minimum setting. Start the heater by turning the safety control valve to the “on” position. If ambient test room temperature is above the lowest control set point temperature, initiate burner operation by placing the thermostat sensing element in a temperature control bath that is held at a temperature below the minimum set point temperature of the control.

2.4.2 Oil burner adjustments. Adjust the burners of oil-fueled vented heaters to give the CO₂ reading recommended by the manufacturer and an hourly Btu input, during the steady-state performance test described below, which is within ± 2 percent of the heater manufacturer's

specified hourly Btu input rating on the nameplate of the unit or in the I&O manual. On units employing a power burner, do not allow smoke in the flue to exceed a No. 1 smoke during the steady-state performance test as measured by the procedure in ASTM D2156-09 (R2018). If, on units employing a power burner, the smoke in the flue exceeds a No. 1 smoke during the steady-state test, readjust the burner to give a lower smoke reading, and, if necessary, a lower CO₂ reading, and start all tests over. Maintain the average draft over the fire and in the flue during the steady-state performance test at that recommended by the manufacturer within ± 0.005 inches of water gauge. Do not make additional adjustments to the burner during the required series of performance tests. The instruments and measuring apparatus for this test are described in Section 6 and shown in Figure 8 of ASHRAE 103-2017. Calibrate instruments for measuring oil pressure so that the error is no greater than ± 0.5 psi.

2.5 Circulating air adjustments.

2.5.1 Forced-air vented wall furnaces (including direct vent systems). During testing, maintain the air flow through the heater as specified by the manufacturer in the I&O manual provided with the unit and operate the vented heater with the outlet air temperature between 80 °F and 130 °F above room temperature. If adjustable air discharge registers are provided, adjust them so as to provide the maximum possible air restriction. Measure air discharge temperature as specified in Section 11.7.2 of ANSI Z21.86-2016.

2.5.2 Fan-type vented room heaters and floor furnaces. During tests on fan-type furnaces and heaters, adjust the air flow through the heater as specified by the manufacturer. If adjustable air discharge registers are provided, adjust them to provide the maximum possible air restriction.

2.6 Location of temperature measuring instrumentation.

2.6.1 Gas-fueled vented home heating equipment (including direct vent systems).

Install thermocouples for measuring the heated air temperature as described in Section 11.7.5 of ANSI Z21.86-2016. Establish the temperature of the inlet air by means of a single No. 24 AWG bead-type thermocouple located in the center of the plane of each inlet air opening. Use bead-type thermocouples having wire size not greater than No. 24 American Wire Gauge (AWG). If a thermocouple has a direct line of sight with the fire, install a radiation shield, meeting the material and minimum thickness requirements from Section 8.14.1 of ANSI Z21.86-2016, on the fire side of the thermocouple only, and position the shield so that it does not touch the thermocouple junction.

2.6.1.1 Integral draft diverter. For units employing an integral draft diverter, install nine thermocouples, wired in parallel, in a horizontal plane in the five-foot test stack located one foot from the test stack inlet. Equalize the length of all thermocouple leads before paralleling. Locate one thermocouple in the center of the stack. Locate eight thermocouples along imaginary lines intersecting at right angles in this horizontal plane at points one third and two thirds of the distance between the center of the stack and the stack wall.

For units with a stack diameter 2 inches or less, five thermocouples may be installed instead of nine. Locate one thermocouple in the center of the stack. Locate four thermocouples along imaginary lines intersecting at right angles in this horizontal plane at points halfway between the center of the stack and the stack wall.

2.6.1.2 Direct vent system. For units which employ a direct vent system, locate at least one thermocouple at the center of each flue way exiting the heat exchanger. Provide radiation shields if the thermocouples are exposed to burner radiation.

2.6.1.3 Draft hood or direct vent system which does not intentionally preheat incoming air.

For units which employ a draft hood or units which employ a direct vent system which does not intentionally preheat the incoming combustion air, such as a non-concentric direct vent system, install nine thermocouples, wired in parallel, in a horizontal plane located within 12 inches (304.8 mm) of the heater outlet and upstream of the draft hood on units so equipped.

Locate one thermocouple in the center of the pipe and eight thermocouples along imaginary lines intersecting at right angles in this horizontal plane at points one third and two thirds of the distance between the center of the pipe and the pipe wall.

For units with a flue pipe diameter of 2 inches or less, five thermocouples may be installed instead of nine. Locate one thermocouple in the center of the pipe and four thermocouples along imaginary lines intersecting at right angles in this horizontal plane at points halfway between the center of the pipe and the pipe wall.

2.6.1.4 Direct vent system which intentionally preheat incoming air. For units which employ direct vent systems that intentionally preheat the incoming combustion air, such as a concentric direct vent system, install nine thermocouples, wired in parallel, in a plane parallel to and located within 6 inches (152.4 mm) of the vent/air intake terminal. Equalize the length of all thermocouple leads before paralleling. Locate one thermocouple in the center of the flue pipe and eight thermocouples along imaginary lines intersecting at right angles in this plane at points one third and two thirds of the distance between the center of the flue pipe and the pipe wall.

For units with a flue pipe diameter of 2 inches or less, five thermocouples may be installed instead of nine. Locate one thermocouple in the center of the flue pipe and four thermocouples along imaginary lines intersecting at right angles in this plane at points halfway between the center of the flue pipe and the pipe wall.

2.6.2 Oil-fueled vented home heating equipment (including direct vent systems).

Install thermocouples for measuring the heated air temperature as described in Sections 37.5.8 through 37.5.18 of UL 730-2016. Establish the temperature of the inlet air by means of a single No. 24 AWG bead-type thermocouple located in the center of the plane of each inlet air opening. Use bead-type thermocouples having a wire size not greater than No. 24 AWG. If there is a thermocouple that has a direct line of sight with the fire, install a radiation shield, meeting the material and minimum thickness requirements from Section

8.14.1 of ANSI Z21.86-2016, on the fire side of the thermocouple only, and position the shield so that it does not touch the thermocouple junction.

Install nine thermocouples, wired in parallel and having equal length leads, in a plane perpendicular to the axis of the flue pipe. Locate this plane at the position shown in Figure 36.4 of UL 730-2016, or Figure 38.1 and 38.2 of UL 729-2016 for a single thermocouple, except that on direct vent systems which intentionally preheat the incoming combustion air, locate this plane within 6 inches (152.5 mm) of the outlet of the vent/air intake terminal.

Locate one thermocouple in the center of the flue pipe and eight thermocouples along imaginary lines intersecting at right angles in this plane at points one third and two thirds of the distance between the center of the pipe and pipe wall.

For units with a flue pipe diameter of 2 inches or less, five thermocouples may be installed instead of nine. Wire the thermocouples in parallel with equal length leads, in a plane perpendicular to the axis of the flue pipe. Locate this plane at the position shown in Figure 36.4 of UL 730-2016, or Figure 38.1 and 38.2 of UL 729-2016 for a single thermocouple, except that on direct vent systems which intentionally preheat the incoming combustion air, locate this plane within 6 inches (152.5 mm) of the outlet of the vent/air intake terminal.

Locate one thermocouple in the center of the flue pipe and four thermocouples along imaginary lines intersecting at right angles in this plane at points halfway between the center of the pipe and pipe wall.

2.7 Combustion measurement instrumentation. Analyze the samples of stack and flue gases for vented heaters to determine the concentration by volume of carbon dioxide present in the dry gas with instrumentation which will result in a reading having an accuracy of ± 0.1 percentage point.

2.8 Energy flow instrumentation. Install one or more instruments, which measure the rate of gas flow or fuel oil supplied to the vented heater, and if appropriate, the electrical energy with an error no greater than one percent.

2.9 Room ambient temperature. The room ambient temperature shall be the arithmetic average temperature of the test area, determined by measurement with four No. 24 AWG bead-type thermocouples with junctions shielded against radiation using shielding meeting the material and minimum thickness requirements from Section 8.14.1 of ANSI Z21.86-2016, located approximately at 90-degree positions on a circle circumscribing the heater or heater enclosure under test, in a horizontal plane approximately at the vertical midpoint of the appliance or test enclosure, and with the junctions approximately 24 inches from sides of the heater or test enclosure and located so as not to be affected by other than room air.

The value T_{RA} is the room ambient temperature measured at the last of the three successive readings taken 15 minutes apart described in section 3.1.1 or 3.1.2 of this appendix as applicable. During the time period required to perform all the testing and measurement procedures specified in section 3.0 of this appendix, maintain the room ambient temperature within $\pm 5^{\circ}\text{F}$ ($\pm 2.8^{\circ}\text{C}$) of the value T_{RA} . At no time during these tests shall the room ambient temperature exceed 100°F (37.8°C) or fall below 65°F (18.3°C).

Locate a thermocouple at each elevation of draft relief inlet opening and combustion air inlet opening at a distance of approximately 24 inches from the inlet openings. The temperature of the air for combustion and the air for draft relief shall not differ more than $\pm 5^{\circ}\text{F}$ from the room ambient temperature as measured above at any point in time. This requirement for combustion air inlet temperature does not need to be met once the burner is shut off during the testing described in sections 3.3 and 3.6 of this appendix.

2.10 Equipment used to measure mass flow rate in flue and stack. The tracer gas chosen for this task should have a density which is less than or approximately equal to the density of air. Use a gas unreactive with the environment to be encountered. Using instrumentation of either the batch or continuous type, measure the concentration of tracer gas with an error no greater than 2 percent of the value of the concentration measured.

2.11 Equipment with multiple control modes.

2.11.1 For equipment that has both manual and automatic thermostat control modes, test the unit according to the procedure for its automatic control mode, *i.e.*, single-stage, two-stage, or step-modulating.

2.11.2 For equipment that has multiple automatic thermostat control modes, test in the default mode (or similarly named mode identified for normal operation) as defined by the manufacturer in its I&O manual. If a default mode is not defined in the I&O manual, test in the mode in which the equipment operates as shipped from the manufacturer.

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3.1.2 Oil-fueled vented home heating equipment (including direct vent systems). Set up and adjust the vented heater as specified in sections 2.1, 2.2, and 2.3.4 of this appendix. Begin the steady-state performance test by operating the burner and the circulating air blower, on units so equipped, with the adjustments specified by sections 2.4.2 and 2.5 of this appendix, until steady-state conditions are attained as indicated by a temperature variation of not more than $\pm 5^{\circ}\text{F}$ (2.8°C) in the flue gas temperature in three successive readings taken 15 minutes apart. The measurements described in this section are to coincide with the last of these 15 minutes readings.

For units equipped with power burners, do not allow smoke in the flue to exceed a No. 1 smoke during the steady-state performance test as measured by the procedure described in ASTM D2156-09 (R2018). Maintain the average draft over the fire and in the breeching during the steady-state performance test at that recommended by the manufacturer ± 0.005 inches of water gauge.

Measure the room temperature (T_{RA}) as described in section 2.9 of this appendix. Measure the steady-state flue gas temperature ($T_{\text{F,SS}}$) using nine thermocouples (or five, as applicable) located in the flue pipe as described in section 2.6.2 of this appendix. From the plane where $T_{\text{F,SS}}$ was measured, collect a sample of the flue gas and determine the concentration by

volume of CO₂ (X_{CO2F}) present in dry flue gas. Measure and record the steady-state heat input rate (Q_{in}).

For manually controlled oil fueled vented heaters, determine the steady-state efficiency at a fuel input rate that is within ± 5 percent of 50 percent of the maximum fuel input rate; or, if the design of the heater is such that the fuel input rate cannot be set to ± 5 percent of 50 percent of the maximum rated fuel input rate, determine the steady-state efficiency at the minimum rated fuel input rate as measured in section 3.1.2 of this appendix for manually controlled oil fueled vented heaters.

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3.2 Jacket loss measurement. Conduct a jacket loss test for vented floor furnaces. Measure the jacket loss (L_j) in accordance with ASHRAE 103-2017 Section 8.6, applying the provisions for furnaces and not the provisions for boilers.

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3.6.2.4.2 If absolutely no smoke is drawn into the combustion air intake, the vented heater meets the requirements to allow use of the default draft factor of 0.05.

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3.8.2 Cyclic condensate collection tests. If existing controls do not allow for cyclical operation of the tested unit, install control devices to allow cyclical operation of the vented heater. Run three consecutive test cycles. For each cycle, operate the unit until flue gas temperatures at the end of each on-cycle, rounded to the nearest whole number, are within 5 °F of each other for two consecutive cycles. On-cycle and off-cycle times are 4 minutes and 13 minutes respectively. Control of ON and OFF operation actions shall be within ± 6 seconds of the scheduled time. For fan-type vented heaters, maintain circulating air adjustments as specified in section 2.5 of this appendix. Begin condensate collection at one minute before the on-cycle period of the first test cycle. Remove the container one minute before the end of each off-cycle period. Measure condensate mass for each test-cycle. The

error associated with the mass measurement instruments shall not exceed ± 0.5 percent of the quantity measured.

Record fuel input during the entire test period starting at the beginning of the on-time period of the first cycle to the beginning of the on-time period of the second cycle, from the beginning of the on-time period of the second cycle to the beginning of the on-time period of the third cycle, etc., for each of the test cycles. Record fuel HHV, temperature, and pressure necessary for determining fuel energy input, Q_C . Determine the mass of condensate for each cycle, M_C , in pounds. If at the end of three cycles, the sample standard deviation is less than or equal to 20 percent of the mean value for three cycles, use total condensate collected in the three cycles as M_C ; if not, continue collection for an additional three cycles and use the total condensate collected for the six cycles as M_C . Determine the fuel energy input, Q_C , during the three or six test cycles, expressed in Btu.

For units with step-modulating controls, conduct the cyclic condensate collection test at reduced input rate only. For units with two-stage controls, conduct the cyclic condensate collection test at both maximum and reduced input rates unless the balance-point temperature (T_C) as determined in section 4.1.10 of this appendix O is equal to or less than the typical outdoor design temperature of 5 °F (−5 °C), in which case, conduct testing at the reduced input rate only.

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